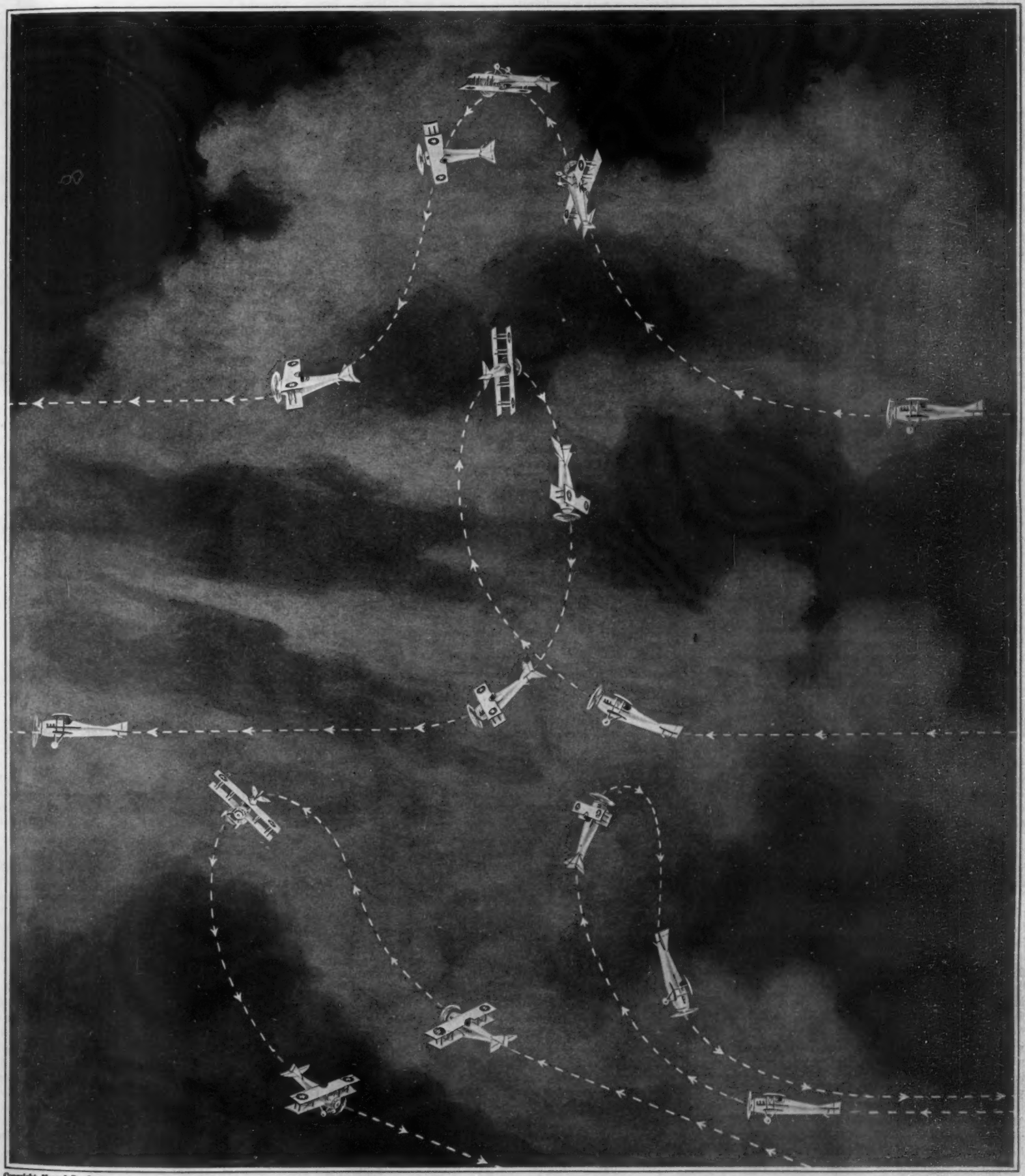
SEVENTY-FOURTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIX. NUMBER 10 | NEW YORK, SEPTEMBER 7, 1918 | 10 CENTS A COPY $4.00 A YEAR



Copyright, Munn & Co., Inc.

Tricks used in aerial combat: First, the "horizontal vrille"; second, the "retournment"; third, the change of direction; and fourth, the "renversement", all as seen from the side. **[See page 188]**

SCIENTIFIC AMERICAN

Founded 1845

Published by Munn & Co., Inc., 233 Broadway, New York, Saturday, September 7, 1918

Charles Allen Munn, President
Orson D. Munn, Treasurer, both at 233 Broadway

Entered at the Post Office of New York, N. Y., as Second Class Matter
Trade Mark Registered in the United States Patent Office

Copyright 1918 by Munn & Co., Inc.
Great Britain rights reserved
Illustrated articles must not be reproduced without permission

The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.

The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.

The Art of Being Interviewed

MANY a preacher or politician, statesman or scientist, or person otherwise in the public eye, has felt the impulse to pause in the uneven tenor of his way for the purpose of calling down anathema upon interviews and interviewers. Such a man finds it an intolerable nuisance to be confronted at all manner of times and places with the demand that he talk about something far from the immediate object of his thoughts. He shares the emotions of the mathematician Klein, who once did a monumental piece of research in invariants; and who, years later, when asked to discuss his results, protested with characteristic profanity that he knew nothing about invariants, that he was working in linear transformations!

It is annoying to be thus beset; but to this as to any other matter there are two sides. The man who is frequently interviewed will say that there are good and bad interrogaters, and that whether an interview is to be a painless or a painful process depends upon the operator. This of course is true; a clumsy worker will make a success here no more than anywhere else. He who has not formulated in his own mind, as well as he can unaided, the subject on which he seeks light, and who accordingly goes into the presence with but a hazy idea of what it is that he wants to know, is doomed to failure before he starts. His victim will perhaps pursue him from point to point; eager to locate and supply his need; but he will succeed only by chance, because the other has not taken the trouble to identify it himself.

An equally discourteous type is the interviewer who is constitutionally incapable of paying attention to what one tells him. There is no limit to the number of times which such a man may hear a thing without heeding it. It was doubtless an interviewer of this class who made a distinguished army artillerist say that the long range shell bombarding Paris "required ten seconds for its flight." To another member of this happy fraternity, we ourselves have repeated six times a name and address and instructions as to how to get there, only to find that he still thought it was in New York instead of Brooklyn, and that he was not yet able to give correctly the name of Dr. Allen Rogers, to whom we wished to refer him. Indeed, our experience with this particular man was so extraordinary that we were forced to recognize him as a strange and unusual phenomenon, quite beyond our previous notions of what was and what was not possible; and we are restrained from giving it here in detail only because we certainly should not be believed if we did. It did not seem humanly credible that a man could listen with such trivial result to something which he wanted to know.

But we started to speak of the other side of the picture. If it takes two to make a fight, it takes no less than two to make a successful interview. The interviewer may be as patient and as skillful and as courteous as he pleases; but he is helpless when confronted by the man who is constitutionally incapable of being interviewed. Yes, such a creature exists, in no inconsiderable numbers. We flatter ourselves that the art of interviewing is not a closed book to us; we feel that when we confront a man we know what we want to ask him, and how to ask it, and that we have reduced to a minimum the number of things which it is necessary for us to ask him. But we find plenty of people who cannot be interviewed, even on that basis.

There is the man who will not let us get started. He takes the whole thing out of our hands, and interviews himself for our benefit. He greets us with a hearty "Oh, yes; you want to ask me about so and so. Well. . . ." And he proceeds to talk continuously for an indeterminate time, developing his subject from the ground up, warming to his work as he proceeds, giving an admirable easy first course for beginners. But he never tells us one thing with which we are not acquainted, he never arrives at any of the points which concern us, and he refuses to give us opportunity to break into his eloquent discourse and turn it in the direction we wish it to follow.

Then there is the man who lets us start our attack, but no more. He breaks into the middle of our every sentence, turns it about and completes the question for us with a different meaning of his own, and answers it. To the best of our knowledge and belief, this man actually prides himself upon being always able to find out at once what it is that a caller wants to know. But he is no whit worse that the gentleman who hears us out, all attention, and starts to answer us; and who, just as we have begun to cherish hope that here, at last, is a man who knows how to answer a question, is diverted into some explanatory by-way, in which he becomes permanently lost, never to regain the main track. And there is also the man who answers us, but with so many qualifications, with so much "However, that depends" and "But on the other hand" and "Of course, if" that when he is through we are lost.

Sometimes we come away from an interview with exactly what we went for. Far more often we depart with a substitute or with nothing at all. We live in hope that some day we shall find the courage to cut off one of these worthies, to say with firmness, "My dear sir, I am perfectly familiar with half the things you are telling me, and in the other half I have not the slightest interest. Won't you please stop, and hear what it is I want, and give it to me?"

We yearn for the interviewee who understands that a lecture is one thing, and an interview another. If a man will hire a hall, and get people to come and listen to him therein, he is quite right in telling them what he thinks they ought to know and don't. They have probably come to hear him as a diversion, so no harm is done in any event. But when some one goes to him for specific information, why can he not abandon the technique of the lecture, and permit the interviewer to have just what he wants? Is the art of being interviewed a lost one, or is it one that never existed?

Safeguarding Our Military Ideas

OUR national characteristic of seeking publicity is one that must stand watching in these days of war. We Americans forget only too often that the Germans, our enemies, have access to all or most of our periodicals and newspapers through agents and agencies in neutral countries bordering the Central Powers. Thus time and again there appear ideas of a military character in our periodicals ostensibly for the purpose of calling the attention of officials and public to them, whereas the attention of enemies is also directed toward them.

The editorial staff of the SCIENTIFIC AMERICAN ever since the war has come in contact with numerous men with good, bad, and indifferent military ideas. In some instances these men have come to this publication, asking for an opinion on their ideas. Others there are who have first tried to interest the Government authorities, and, failing in this, have sought the utmost publicity for their ideas, believing that in this manner they could secure public favor and eventually compel the authorities to reconsider, if not adopt, their ideas.

A concrete instance can be cited, in order better to illustrate the point of this warning: A man came to this office with a most ingenious apparatus for detecting submarines, about one year ago, when it was generally understood that such devices, although in use by the Allies and ourselves, was crude and uncertain. He stated that he had endeavored to interest the various Government boards but without success. He was seeking publicity in order to secure his due share of credit for the ultimate perfection of submarine listening devices. Now the Government boards had made it quite plain that they were not ready to take up his idea as it stood, so there seemed no harm in giving the idea due publicity in the columns of any scientific journal. A drawing was prepared showing a typical apparatus of this kind. At the eleventh hour the Government board, reconsidering the matter, requested the article and drawing to be withheld. In accordance with this request the article and drawing were voluntarily held out from a certain issue and to this day they have not as yet appeared.

What would have been the result of publishing such an article and sketch is difficult to say. For certain, the idea would eventually have come to the notice of the German authorities, who, with their usual promptness to adapt new ideas to their ends, would no doubt have derived some benefit from something published in absolute good faith. Just then the U-boats were also in need of a practical listening device.

So it has been with many an idea withheld from publication in these columns, either on our own initiative or at the request of the officials. We regret to state that certain other publications have not considered the matter in the same light, and numerous ideas which have been treated as rather fantastic have been given utmost publicity because they made for interesting reading matter. Yet nothing is too fantastic for our enemies. They have shown us that they do not hesitate to use poisonous gases, flame throwers, crewless torpedo boats steered by wireless, low-flying airplanes heavily armored, and other equally fantastic weapons.

A New Kind of Specialist, and What He Can Do

THE engineer graduates from his alma mater as a civil engineer or a mechanical engineer or a mining engineer or an electrical engineer; but he does not long retain any such broad designation. He either attaches or permits the world to attach a qualifying adjective to his professional title; he becomes a storage battery engineer or a cyanide engineer or an elevator engineer or a boiler engineer or some other kind of a specifically designated engineer in a specialized field. And while there is no limit to the number of subdivisions which may thus be created within the larger profession of engineering, we can never refrain from feeling the thrill of discovery when one of these gentlemen confronts us with a professional title which we hear then for the first time. The latest case in point is afforded by the "by-products engineer."

We suspect that by-products engineer will have to be recognized as a permanent addition to the technical community. It is not merely that just now by-products utilization is so very fashionable; it has attained this vogue through merit. The war has made us realize as never before that, of every kind of matter, there is in this world of ours just so much and no more. The man who finds a use for matter which has always before escaped unused is a benefactor of the race by virtue of this very fact, quite aside from the direct money value of his discovery, or its indirect financial bearing in lessening the costs of primary products. Today we admit as yesterday we never dared admit that our stocks of nothing in the world are inexhaustible; so the man who adds at any point to the visible stocks of useful materials has earned our thanks.

The work of the by-products engineer is no more a novelty; he has been on the job long enough to make it necessary that he look sharply in his search for more things to utilize. It is not easy for him to find a place where he has not been forestalled. But the thrill of discovery which we have just mentioned is nevertheless occasionally his.

The particular by-products engineer who is responsible for the train of thought which we here set down has had an experience in this direction that seems interesting enough to record. He had for some time had in mind a reinforced rubber fabric, patterned more or less upon reinforced concrete, and to be formed by filling in a tubular or spongy mass with rubber. But he had searched high and low for the proper base, without success. He had tried various metals, and everything else he could think of; but none of them added strength to the rubber without a disproportionate sacrifice of elasticity. And there the matter rested when the man with the idea stumbled across what he insists is the largest single waste product that remains unutilized.

This product is fish scale. In the case of one or two less common varieties of fish, it has been customary to make an artificial pearl from the scale. But with this exception, the vast amount of scale removed from fish in canneries and wholesale markets and retail stores has been an absolute waste, with not even a suggestion of possible utilization. Like flue gases and culm heaps before the by-products engineer got hold of them, it has been actually a nuisance which had to be got out of the way with as little expense as possible.

When this state of affairs came to his attention, our man got a supply of fish scale, and investigated its structure and properties—purely by second nature, because it was a waste product. But when he found that it was a cellular mass, of tubular structure, as resilient as rubber but much tougher, and that it made no difference at all what kind of a fish it came from, his interest in it ceased to be one based on general principles. He at once tried it out as a base for his cherished reinforced rubber, and found that it worked like a charm; it made the rubber tough, without robbing it of its elasticity.

This of itself would have been sufficiently pleasing; but the final consummation, which came later, by sheer accident, made it look like the proverbial three-tenths of a dollar. Rubber is hardened, or vulcanized, by treating it with sulfur. To make a long story short, the inventor discovered that fish scale would take the same sulfur treatment, with the same result. So after he has rubberized his fish scale and got a tough, elastic fabric, he can vulcanize the combination, and get a hard, tough, elastic fabric. He has accordingly taken out as broad patent protection as he could induce his Uncle Samuel to give him, and is now busily engaged in finding out just how far he can go in the rubber business with his new material. The most exhaustive tire tests have had no effect upon his optimism save to increase it; and indeed, when a man begins to talk about a rubber that shall be far harder and far tougher than rubber has ever before been made, without loss of resiliency, it would seem that he has something to talk about.

Electricity

Influence of Hydrogen on the Resistivity of Carbon.—A contribution on this subject by Mr. T. Peczalski of the Nela Research Laboratory, Cleveland, Ohio, has appeared in a recent issue of the *Physical Review*. It was found that at ordinary temperatures hydrogen produces no material effect on the resistances of carbon for pressures up to 33 atmospheres, but the resistance increases considerably when the filament is heated in a hydrogen atmosphere to a high temperature. Moreover, at room temperatures the resistance following such a heating shows a further increase. This effect is greater for high pressures than for low pressures. It can be counteracted by a subsequent heating in vacuum.

Cost of Motion-Picture Arcs in Coal Consumed.—In a recent paper dealing with the use of incandescent lamps for motion-picture projection, read before the American Illuminating Engineering Socicty, it is pointed out that their substitution for arcs in projecting machines of all the theatres in the United States would bring about an annual saving of 160,000 tons of fuel. The consumption of energy is approximately half that needed for the arc lamps. However, as yet the incandescent lamp has certain limitations. For limited throws and size of picture it is quite satisfactory and practical; but for large theaters where the throw and the size of the picture are great, the required volume of illumination can only be secured with the conventional arc.

Electrical Detection of Ores.—A recent United States patent taken out by Prof. R. A. Fessenden refers to a method of locating deposits of ore by electrical means. Bore holes are made in the area under investigation at a distance apart of several miles. For example, in a typical case four such holes would be bored five miles apart and the apparatus used would consist of a Fessenden sound oscillator and three Einthoven recording oscillographs. The holes are filled with water, in which the sending oscillator and the receiving microphone are immersed. By studying the records on the oscillographs, and particularly the relation between sound received direct and through echoes, it is possible to form conclusions as to the nature of the intervening rock and the distances of ore deposits in the vicinity. It is stated that beds of ore have been detected at a distance of 2½ miles.

Small Electric Hoist.—Small electric hoists are adapted to almost every kind of work involving hoisting and form a very economical means of hauling loads of from ½ ton to five tons, because they can lift with from five to ten times the speed of a hand-operated chain hoist and their cost is but a fraction of that of an electric traveling crane. They can be suspended from a fixed point, shear pole, jib crane, trolley running along an overhead track, or small traveling crane. The trolley or crane when used can either be pulled along by hand or by motor. These little hoists, continues the *Electrical Review*, are controlled from the floor by means of pendent ropes. A brake, which is automatically applied when the controller is returned to the off position, holds the load suspended, and a safety switch cuts off the current when the hook in hoisting reaches its safe limits of travel. Special mechanical and electric features are used in the construction of the motors suited to this class of service. The direct-current motors are modifications of the series-wound crane type. The alternating-current motors are of the polyphase squirrel-cage type with high-torque rotor windings.

An Oil-Immersed Strain Insulator.—In a recent issue of *Electrical Review and Western Electrician* there appears an interesting description of some special insulators used in connection with the four three-phase, 60,000-volt circuits and three grounded overhead conductors, installed at Maumee River. The span of 1,300 feet is supported by 190-foot steel towers on either bank. The voltage on the insulators will, eventually, be 66,000 volts and the load carried by each insulator will approximate 6,000 pounds. The insulator is made up of two heavy wooden members which are connected together by an end casting of special design, and so arranged that the stresses between the wooden members are at all times equalized while the grip of the end castings increases with increasing tension. A porcelain jacket or sleeve, equipped with two integral flanges, surrounds these wooden members. This porcelain sleeve is never under tension, however, and acts as a container for the oil or compound with which the insulator is filled and is designed to keep the flash over on the outside. A reservoir is provided to take care of the expansion and contraction of the oil or compound under varying temperatures. The joint between the porcelain sleeve and the end casting is flexible so as to allow for unequal expansion and contraction and yet is so designed that leakage of oil or compound cannot occur under the most extreme variations of position. The insulator described measures more than four feet overall, the larger insulator petticoat having a diameter of 15 inches. This type of insulator is now being built for 120,000-volt service to carry continuous loads of approximately 35,000 pounds.

Science

New Fisheries Laboratory at Fairport.—Congress has provided the sum of $80,000 for the construction and equipment of a fireproof building to replace the laborator of the U. S. Bureau of Fisheries at Fairport, Iowa, which was destroyed by fire last December. Pending construction temporary quarters have been provided for the staff, so that the work of this important research and fish-cultural station will nlt be interrupted.

Lead Poisoning in Waterfowl.—According to Mr. Alexander Wetmore, of the U. S. Biological Survey, lead poisoning in waterfowl, which has been known for a number of years, has recently assumed considerable economic importance. Wild ducks, whistling swans and a few other birds subject to the disease, pick up and swallow pellets of shot lying in the mud in marshes and shallow lakes about old shooting blinds. The shot remains in the stomach until it has been ground into fine particles by bits of gravel, swallowed to aid digestion, and part of the lead is progressively absorbed into the system, resulting in slow paralysis, emaciation and death. Mr. Wetmore's experiments show that in some cases a single No. 6 shot is sufficient to cause death by lead poisoning.

Walnut Pollen Causes Hay Fever.—According to Prof. H. M. Hall, of the University of California, "the prevalent assumption that the tree pollens play only a minor rôle, if any, as causative factors in hay fever must now be abandoned, since one species alone has been demonstrated to be the cause of hundreds if not indeed thousands of cases in California." The tree in question is the California black walnut (*Juglans californica*, var. *Hindsii*), much used as a shade tree in certain towns of the Sacramento valley. Hay fever of the spring type is very prevalent in this region and coincides in time of occurrence with the sifting down of abundant pollen from the black walnut. The treatment of numerous hay-fever subjects to render them immune to hay fever has been undertaken, serums prepared from black walnut pollen being the ones most used. Professor Hall suggests investigation of the relation of black walnut to hay fever in the eastern states.

The Nation's Health as Shown by the Draft.—It is obvious that the medical examinations in connection with the selective draft furnish data of immense value for studies of the health and physique of the population in the various parts of the country. Although a thorough analysis of the causes of rejection would be an enormous task and has not been undertaken, some interesting conclusions have been drawn from the provost-marshal's preliminary report by Miss Gertrude Seymour and published in the *Survey*. The states showing the highest percentages of men of draft age physically unfit for military service were Pennsylvania (46.67 per cent) and Connecticut (46.30 per cent), while the lowest percentage was found in South Dakota (14.13 per cent). Out of 10,258 rejections in eight camps, 2,224 were for eye troubles. In the same group defective teeth were the cause of 871 rejections, while hernia accounted for 766. These were the three commonest defects. Rejections for tuberculosis numbered 551, or 5.37 per cent.

Effects of an Earthquake in a Mine.—Persons who have been in mines during earthquakes of more or less pronounced intensity at the surface have recorded quite different experiences, some claiming that the shocks were imperceptible in the mine, and others stating that they were quite plainly felt. Probably the conditions actually differ a good deal with differences in rock structure, the neighboring rocks in one case transmitting the vibrations readily and in the other absorbing and deadening them. In the *Bulletin* of the Seismological Society of America, Mr. W. F. Staunton, a mining engineer, describes his own observations in a mine at Tombstone, Ariz., in May, 1887, during a widespread earthquake which, at the surface, caused plaster to fall, threw down chimneys and disarranged foundations. At the time of the shock he was in a large inclined open stope about 150 feet below ground. The first warning was a heavy roaring noise, followed almost immediately by the beginning of vibration, which seemed to culminate in a very pronounced jolt. Loosened rocks from the hanging wall crashed down. In a neighboring mine the shock was felt at a depth of 500 feet. A man standing in a drift in hard white limestone felt impelled to brace himself against the wall to maintain his equilibrium, and distinctly saw, as he afterward stated, a wave or deflection in the solid rock approach and pass him. Mr. Staunton concludes, however, that while earthquake vibrations may be felt at depths of several hundred feet they are probably not a serious source of danger in mines. Probably, as suggested by Sieberg, in his "Handbuch der Erdbebenkinde," earthquake waves are of relatively small amplitude at great depths on account of the great weight of the overlying rock. It may be added that a special type of earthquake appears to be caused by mining operations and seismographs have been installed in certain mines in Belgium and elsewhere for the purpose of studying the phenomenon.

Aeronautical

Postal Planes Between Holland and England.—Negotiations for aerial postal service have been completed between the British and Dutch governments, and Holland is very busy making final arrangements. The journey from Amsterdam to London would take but 1½ or 2 hours. The Dutch military airmen, who have been in training since the beginning of the war, are to act as pilots; and the ministry of war is lending full coöperation to the scheme. On the same lines an air service between Amsterdam and Groningen is also being arranged. Ground for large airdromes is being prepared near the Dutch metropolis.

Italian Propaganda Raid Over Vienna.—A commendable aerial achievement was undoubtedly the propaganda raid of an Italian air squadron under the command of none other than Captain G. d'Anunzio, when seven monoplanes and one biplane reached Vienna and released large quantities of proclamations. All the machines returned safely to Italian territory with the exception of one, which is said to have experienced motor trouble. In all, the flight must have been well over 600 miles, most of which was above hostile territory. The population of the Austrian capital did not fail to read the proclamations, and from what has been permitted to come through the Austrian censor it seems that they made a deep impression on the war-sick people.

A Spad on Skids.—A recent photograph which has come to our attention depicts an interesting Spad of strange design employed by the Ukranian forces. While following the general lines of the well-known French Spad, this machine is provided with a nacelle placed in front of the propeller and held in place by a coupling with the propeller shaft and additional strut members connecting with those of the landing chassis. Of course, this additional nacelle, intended for a gunner who can work a gun free of the propeller's sweep—in other words, giving to a tractor machine the advantages of a pusher—has been described and illustrated some year or more ago in these columns. Most novel of all, however, is the substitution of skids or sled runners for the usual wheel, so that this machine can be used over soft snow.

Effects of Doping.—According to the opinion of a British government specialist, non-poisonous dopes, which have been substituted for the poisonous airplane dope formerly used, are more nauseating in smell and taste than the old. Mr. W. S. Smith, Inspector for Dangerous Trades, in a report says that the standard of ventilation was raised to meet objections of the workers, and in one works it was found to be as high as 125 changes of air per hour. An investigation as to the blood condition of dope-room workers in three factories in the London area showed that a mild degree of anaemia exists among them, but is of no practical importance except as an indication that any relaxation of regulations might be accompained by cases of serious illness. Nevertheless, the average person would prefer to be nauseated by a non-poisonous rather than to be made the subject of an inquest by a definitely poisonous one, remarks the editor of *The Aeroplane*.

Airplane Flare for Night Bombing.—Announcement has been recently made by Major-General C. C. Williams, Chief of Ordnance, of the perfection and the adoption by the Army for use in France of an airplane flare for night bombing. According to Major-General Williams, the flare is released from a bombing plane by pulling a lever. As it drops the resistance offered by the air sets the fuse mechanism in operation. The result is the emission of a powerful light of from 300,000 to 400,000 candlepower, which completely illuminates the terrain below. The amount of light given is equivalent to that of a battery of from 150 to 175 street arc lamps or from 15,000 to 17,500 ordinary incandescent lamp bulbs such as are used in the home. As soon as the flare gets into operation a huge parachute, made of the best quality silk, opens and holds the brilliant light in suspension in the air for a sufficient time to allow the aviator to select his objective or target. The bombs then follow.

Test Flight of Leoning's Monoplane.—The first flight of a two-seater monoplane designed and built by Grover C. Leoning, the aeronautical engineer and constructor, at his factory in Long Island City, was made at the Army Aviation Field at Mineola on August 4th. While details of the construction of the machine and the flight are not available for publication, it is claimed that the construction is such that the pilot has an unusually large radius of vision and the gunner has practically no "blind spots." It is stated that the unique design of the machine has overcome the well-known drawbacks of the monoplane in strength and vision and that in flight the machine showed low landing speed and exceptionally good stability. It is claimed, continues *Aviation*, that the simple design of this machine permits its construction with about one-tenth of the number of parts of the ordinary machine. It is powered with a 300-h.p. Hispana-Suiza engine.

The Government's Vast Building Program

Two Billion Dollars Worth of Construction Required for Our Army

By Col. W. A. Starrett, U. S. A., Chairman of the Committee on Emergency Construction, War Industries Board

THIS is the first of a series of four articles dealing with the vast building program of the Government. The second will deal with the Government's emergency construction contract; the third will tell of the Construction Division, the Government's organization for the supervision of its building work; and the fourth will have to do with recommending a contractor.—EDITOR.

THE Government's building program occupied a peculiar position in the vast problem that confronted us in the spring of 1917. In the first place it was not fully recognized. Men's minds turned to arms and munitions and men, and each was a specialty. It was not a far cry to think of a steel mill turning out forgings and a machine shop working them up into cannon, or a chemical concern turning in to make explosives, even though the processes were not understood or even discerned. It was little realized, however, that before any of these things could be done on any considerable scale a vast building program had to be inaugurated. Structures of every conceivable kind had to be had at once, as a necessary precedent to preparation. Our engineers and builders were aware of what was to take place, however, for they had had an age of experience with the frailty of human nature that puts off till the last the most disagreeable of its tasks. They were used to being called in after the patient was half dead. American industry had formed the habit of deciding upon its desired objective, ruminating on the product it would deliver, finally deciding to deliver it, and then waking up to the fact that a building problem stood squarely across the path of any possible action. Our building and engineering industry had been keyed up to this situation as is evidenced by our world-wide reputation as rapid builders.

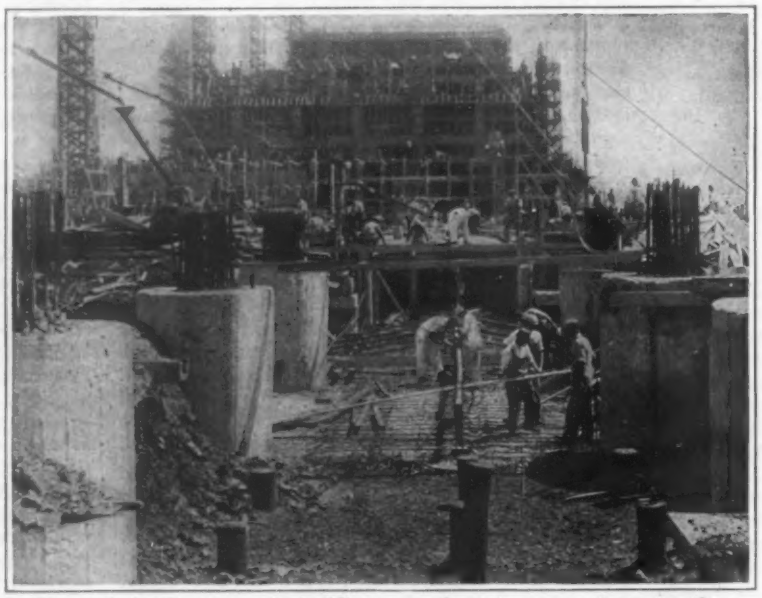
So, what the Government did not sense, the builders were in a measure prepared for and thus it happened that the first great visual accomplishments of the war were cantonments constructed with lightning rapidity all over the country which made possible the calling of the draft army at the time designated.

It is an unfortunate lapse of human nature that makes everyone feel that he is an expert on building. A few superficial facts will start the average citizen blithely on the path that angels fear to tread. Then there is the old saw about the crooked contractor, generally accompanied by the startling tale of how the wily owner, by an adroit exhibition of brains, circumvented the scheming scoundrel, bought a package of cure-all in the corner drug store for 15 cents and, by pouring it down the plumbing pipes as per directions, fixed everything in sight, ending up by kicking the contractor out of the door, thus saving $1,500 and establishing himself as an expert who thereafter would never need consult anyone about building.

Is it any wonder that with the influx into the Government of thousands of new executives, nearly all of whom had had a taste of this sort of pap, the building problem, as a problem, should have been largely overlooked even when brought to their attention in its true and startling proportions by people who really knew? But the solution of the problem has to take even another hurdle before fog commences to clear and any headway is possible. The old fetish that anybody can build is coupled with the question of the technical use to which the building is to be put. At once one of the most expensive fallacies of the war is created. The dentists need a building, they know how they are going to use it and they want certain special ideas incorporated. Immediately they reach the conclusion that dentists must build it and away they go, a lot of dentists organizing construction gangs, inventing systems of accounting and supervision, making deals with labor unions, etc. The remount men, in their collecting of animals for the service, need special structures and immediately we find a lot of horse experts and veterinarians and farriers attempting to get a great building enterprise under way.

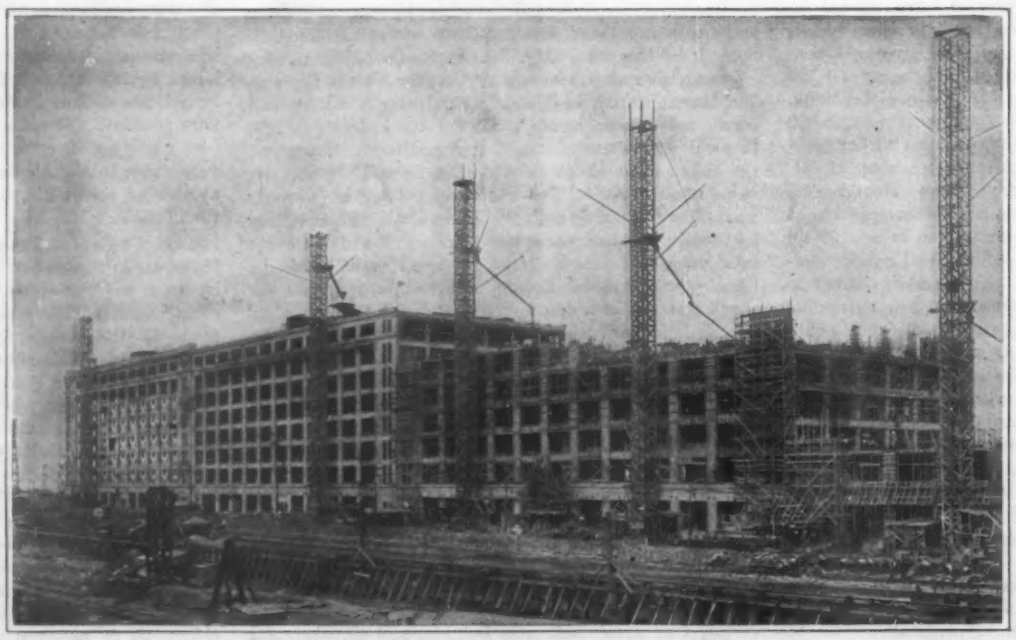
Organizing a Construction Division

But to return to the subject; it is to the everlasting credit of the Government that it early saw how many building specialists it really had and decided that, if the war was to be conducted, a few people ought to be turning their attention to the activities for which they were brought to Washington. By orders issued by the Adjutant General, all of the building for army war purposes in this country was put under one head—the Construction Division—specially organized, at the instance of the War Industries Board, for this great undertaking. The Navy, Shipping Board and Housing are not included. The general situation, therefore, as it exists today is that there are four agencies building for the Government; the Navy, the Shipping Board, the Industrial Housing Administration and the Construction Division of the Army. Of the three former the writer is not qualified to speak, but of the latter, which controls from eighty per cent to ninety per cent of the whole Government building program, he is qualified and it is with a view of throwing some light on that aspect of our war preparation that this article is written.



Many of the Government's buildings are of most permanent construction

Tens of thousands of creosoted piles had to be driven



This colossal structure represents less than five months' work

The Government building program here discussed can be divided roughly into four parts: First is the housing of troops which includes cantonments, base hospitals, national guard camps, embarkation depots and, in fact, all works that largely involve these quickly built wooden structures. Next come the port and terminal facilities, involving docks and wharves and storehouses of more or less permanent character. Then there is the branch of ordnance work which involves lethal gas manufacture, and included in this, but not necessarily connected with it, are the proving grounds and ordnance storage. The fourth is the powder and high explosives program—structures on a vast scale located in out-of-the-way places where cities have to be built out of the whole cloth as it were. In this group are included the nitrate and picric acid plants and many others that manufacture the elements of which explosives are made. Loading plants might also be included in this group. Perhaps a fifth group would be industrial enlargements—subsidized additions to existing plants such as steel mills, or ordnance forge shops, or converted factories where clothing, small arms and such things as gas masks are made. These latter, however, have not generally come under the purview of the Construction Division because of the varying degrees of ownership as between the Government and the manufacturer; also perhaps on account of the fact that these extensions could best be handled by the people on the ground to whose existing properties they are generally attached.

Housing 1,500,000 Men

Each one of these programs has difficulties peculiar to itself. However, a general survey of the problem, made by the War Industries Board early in the war, indicated that all emergency construction operations would have enough points in common to warrant certain generalization of method, and it was along these lines that the Board laid down the principles upon which the work should be undertaken. The story of the cantonments is old, although even now it is generally misunderstood. Here we were in the war with an army about to be called. Shelter and facilities for 1,500,000 men had to be created and the work started everywhere over the country with hardly a breathing spell in which to consider details. Contractors flocked to Washington wanting to bid but there was nothing for them to bid on because detail plans had not been made. It was plain that the only thing left for the Government to do was to organize itself so that the contractor and the Government's representatives should go into the field together, there to work the thing out in detail with the least possible loss of time. What were the problems? In the first place sites were not even known and yet the typical buildings had to be designed so that they could be adapted to such sites as might be selected. The design of certain special buildings such as hospitals, had not been determined, so great open spaces had to be left in any sites that were reported, wherein these hospitals, etc., could afterward be located. The topography was not known, yet sewerage, drainage and water supply had to be considered. Last of all, the extent of the project itself could only be guessed at and yet the work had to be started at once. The situation would have been the happy hunting ground for the irresponsible contractor had he been allowed to bid even on the few parts of the work upon which there seemed to be more or less definite information. All he would have wanted was a toe hold on this disturbed situation, for as a gold mine for extras it would have had ab-

solutely no parallel in building history.

Therefore a contract had to be devised that would safeguard the Government's interest and to this task the War Industries Board first addressed itself. Beyond that, the obtaining of services of contractors of merit demanded a careful nation-wide survey of the contracting industry, and, under the direction of the Board, this was made. Then, third, was the question of the Government's own administrative forces, and, after much study and conference with experts, the scheme of supervisional and administrative organization was laid out by the Board. Individuals to fill the important posts were summoned to Washington and asked to enter the new Construction Division (then called the Cantonment Division). And on these three supports, the low compensation contract, the spirit of mutual cooperation between the contractor of experience and responsibility and the Construction Division organized to administer the one and supervise the other, the War Industries Board launched its solution of the whole army building problem.

Shortly after the formation of the Construction Division, and before its activities were well under way, the storage program commenced to loom large on the horizon. The structures here involved were more permanent. Masonry and steel took the place of wood, and railroad terminal facilities on a large scale, together with vast dock and pier improvements, came up for immediate construction. Single operations involving from twenty to forty million dollars were presented by the army for immediate consideration and execution—and all had the common characteristic of great haste and lack of detailed information.

Copyright, Underwood & Underwood

Prime Minister of Newfoundland at a tank-gun school in France

Structures in Which Lethal Gases are Manufactured

The making of lethal gases involved much that had been encountered in both the cantonment and storage programs, but it involved more. It demanded structures like which none had ever before been built, special machinery arrangements and special buildings of all sorts to take care of this gruesome business. Here we had a condition that demanded experimentation at the site. No amount of prevision would have established the detail of this peculiar construction. It was a new and undeveloped industry; much of it of necessity had to be worked out as it proceeded, and then there was the haste. Again the building policy stood the test and, through its operation, the Construction Division and the contractors have been able to deliver these new and untried manufactories on time and in successful working condition.

The explosive end chemical program partook of the complication of all three of the foregoing program and had the additional difficulty of bigness. Two projects alone have cost over fifty million dollars each and several range from fifteen to forty million.

It is not to be inferred that all the vast building program went through without effort or friction. When the War Department's policy on its building program was first announced a storm of protest arose from quarters unacquainted with the situation. The old hue and cry that every one should be allowed to bid on the work arose and members of Congress were fairly besieged by their constituents, contractors and otherwise. The contracting industry itself however was not long in realizing the situation and the individual concerns commenced to busy themselves with bringing before the Government their claims for consideration as contractors for the work. This action on their part threw an interesting sidelight on the wisdom displayed by the War Industries Board in starting its very complete survey of the industry.

Investigation by a Board of Experts

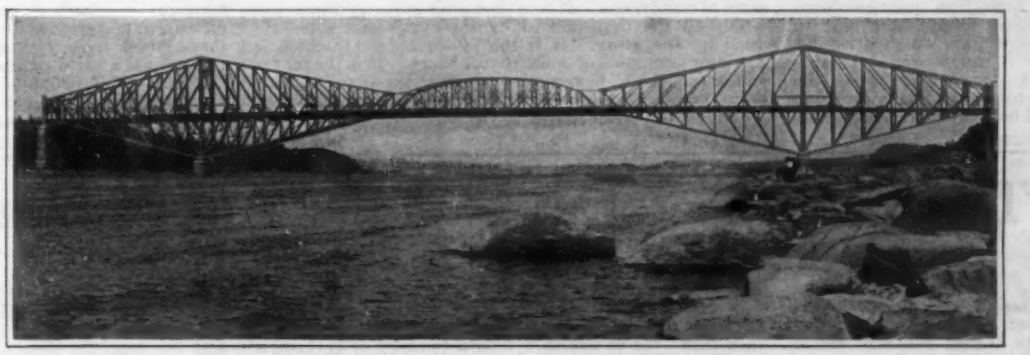
As this great building program progressed and grew in magnitude, the misunderstanding of it grew space. Finally the Assistant Secretary of War directed that a board of experts be convened to review the whole question, and pursuant thereto on March 15th, 1918, that Board composed of the presidents of the leading engineering societies and a few others fully representative of the industry and the public, reported on the whole question.

To that body the Construction Division gave testimony which at this time is interesting in showing that the War Industries Board had correctly gaged the problem in the beginning. Asked to give this special board a resumé of the work it had been doing, the Division reported in part as follows, under date of March 14th, 1918:

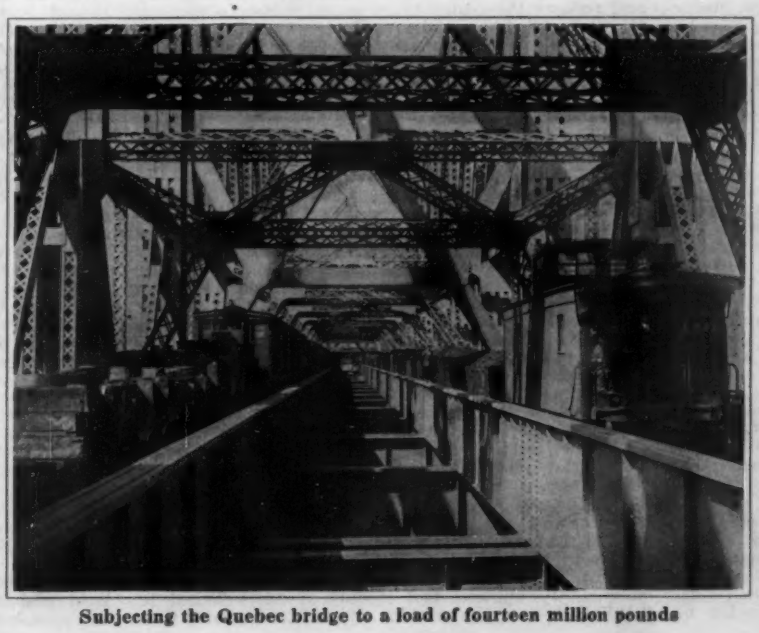
"It was at first decided to build 32 cantonments. This number was later changed to 16. The estimated cost of first original 16 cantonments was approximately $5,000,000 each. It was thought that additional construction would be added and this thought proved correct. By successive steps from the time of the commencement of the job until completion work was added in the form of additional hospital accommodations, the addition of divisional depots, divisional remount stations, complete changes in the military organizations to raise the companies from 200 men to 250 to suit the Pershing Division and to radically modify the general scheme of military organizations and other like changes so that the final cost of the cantonments was in the neighborhood of nine million dollars each, nearly all of which increase was due to the additional work rather than to poor estimating in the first place, although the original estimates were somewhat low. It must be borne in mind also that many of these changes particularly those caused by the changes in the military organizations were not decided upon until after the first of September, when the contractors were in some cases practically finished with their original jobs and had in several cases materially decreased the organizations.

"In the case of the two largest Port Terminal Developments now under construction the plans were fairly well decided upon and construction started on the basis of the plans fixed. In both cases after the jobs had gotten some weeks along and the organizations were commencing to show material results, in some cases having several thousand men on the job, construction had to be absolutely stopped due to the direction of higher authority and these holdups continued until the matter could be again adjusted. In both cases the work is being carried forward under generally the same plans as were originally contemplated but with enough modifications to seriously affect any lump sum contract. It also developed at one of these terminals that instead of being able to build one-story buildings on the ground, as was originally thought possible, it was necessary to pile for the entire area, including the support of the floors. In another case, the location of the building, which had been

(Concluded on page 197)



The largest bridge span in the world under test



Subjecting the Quebec bridge to a load of fourteen million pounds

Short-Range Rapid-Fire Cannon of British Tanks

BECAUSE tanks were primarily intended as a reply to enemy machine-gun nests, the tendency has been to equip them with cannon. When operating against intrenched positions, a tank must be so equipped; but of late, with the warfare more or less in the open, the tendency has rightfully been to develop lighter, faster tanks armed only with machine guns.

The so-called "male" type of the British tank is provided with one or more rapid-fire cannon. In this connection the accompanying illustration is of interest, showing as it does one of the tank guns. This is presumably a short-range, rapid-fire cannon of three-inch bore or less, recoiling in a sleeve after the fashion of heavier artillery pieces. The French St. Chaumont tanks are provided with the regular "seventy-five," while the German "Panzerkraftwagen" is equipped with a rapid-fire cannon of somewhat less than two-inch bore.

A $5,000 British Motoring Prize

THE offer by the British Automobile Association of $5,000 for the best method of using coal gas on motor vehicles has aroused considerable interest in England. A number of inventions have been definitely entered for competition, and, in addition, many valuable suggestions by motorists and others interested have been received by the Association. Incidentally, the competition has stimulated research and investigation concerning the possibility of using other fuels besides coal gas, and petrol substitutes, while the important question of adequate supplies of coal gas and benzol for post-war motoring requirements has, likewise, received much-needed impetus. Entries for the competition, also correspondence, have been received from well-known engineers and gas experts, private motorists, members of the motoring industry and working men and mechanics many of whom have for some time past been endeavoring to devise practical and inexpensive methods of propelling motor vehicles with coal gas and other fuels. Entry forms and letters concerning this competition have been received from motorists serving with the forces in France, Italy, Salonica, and Mesopotamia.

Hardening Steel Automatically and Accurately

BASED on the fact that carbon steel at its non-magnetic point is at the best temperature for quenching for the purpose of hardening, an automatic detector has been perfected by a British company, which the company fits to electric heat treating furnaces. The furnace chamber consists of an inner pot, which contains a special mixture of salts having a comparatively low melting point but a high vaporizing point. The pot is wound with a heating coil, and is provided with a special heat-resisting lagging. Round the outside case of the furnace is wound an insulated copper coil, the ends of which are connected to a special galvanometer. A current of electricity passed through the heating coil quickly heats the furnace and renders the salt mixture molten, and also magnetizes any steel article that is placed in the pot. When the steel has been heated to the non-magnetic point the consequent deflection of the galvanometer needle informs the attendant that the best temperature for quenching has been reached. A 4-inch furnace will, it is stated, harden 10 pounds of tools, gages, or other articles in an hour.

Testing the Great Quebec Bridge

THE readers of the SCIENTIFIC AMERICAN will be particularly interested in the test of the Quebec Bridge which took place on August 21st. This bridge has a span of 1,800 feet from pier to pier, which is the longest in the world. The next longest spans are those of the Forth Bridge which has two of 1,710 feet each.

It will be recalled that in the original design the cantilever arms were to be built out from each shore to meet over the center of the river. One of the cantilever arms was very near completion when, owing to faulty design, the structure collapsed and fell into the river. On the second attempt to bridge the St. Lawrence at this point, it was decided to have the cantilever arms reach out 580 feet from the piers and to fill the gap with a 640-foot span which would be lifted up by means of hydraulic jacks from floats in the river. The suspended span was built of nickel steel to reduce weight. Its weight was about 5,000 tons. This, also, resulted in failure owing to a fault that developed in the means of securing the span to the hoisting jacks. Work was immediately started on another span, and the member was finally raised to position last fall, 145 feet above the river, thus completing the bridge.

In the test of this bridge two weeks ago, two heavily loaded freight trains were run over the structure and allowed to rest on the span simultaneously. They weighed approximately 14,000,000 pounds. The bridge stood the strain admirably, and there is no further question of its ability to stand the consistently heavy traffic for which it was designed.

Is the Motor Car a Non-Essential?

How Conditions in the United States Differ from Those in England

By A. Russell Bond, Managing Editor of the "Scientific American"

IT is sufficiently easy to answer the question in the title by an explosively emphatic "No!" But something more than a fierce partisanship attitude is necessary to convince those legal powers that be who have, to a large measure, the future of the American automobile industry in their hands.

It has been falsely argued by many—and one would be willing to wager much that those who so argue have little personal experience or need of the services of an automobile—that because Great Britain has found it necessary almost wholly to eliminate her automobile industry in favor of munitions making, therefore we of the United States should do the same. It is but another variation of the same argument to quote Germany, where the motor car except in war work has disappeared, or France, where the use is extremely restricted and the manufacture almost entirely stopped except for trucks and war cars.

But the conditions confronting the two principal foreign Allies, and the enemy of civilization, and those which we of America face, are so radically different that to quote their action and necessities as a reason why we should pursue a similar policy is about on a par with saying that because Germany bombs hospitals, so should we, or that because Germany finds the submarine her greatest comfort, so should we depend upon it for winning the war!

British vs. American Conditions

Great Britain is a huge country. But the British Isles, where most of her motor car factories have been located, is a very small territory, indeed. It is well covered with railroads, and is besides thickly settled. There is infinitely less economic need of the swift transportation of the motor car in England than in a country like this, where we have single states larger than all England, and with less population than one small sized British city.

Again, the size of Britain's automobile industry, great as it is, is hardly to be mentioned with that of the United States. England, for instance, has no parallel for three huge American concerns, which turn out cars comparatively inexpensive, in quantities quite amazing. We have been exporting a great many more cars to England than we have been importing, which is itself a sufficient indication that her industry was not large enough for her people. As a consequence, when the vital need was munitions factories, it was natural to swallow all or practically all of her manufacturing plants devoted to cars, in molding that industry to the point of supplying her army with shells and guns.

Had we had to depend exclusively on remade automobile factories to supply our munitions, we would still have a surplus left over to produce cars.

England has to import her gasoline. We produce it. What she could get she had to conserve for war trucks, for airplanes, for submarines. We have plenty of it, if consistently used.

Germany, of course, needs every pound of steel she can get, every ounce of rubber, every drop of gasoline, for her armies. There is no possible parallel between her situation and ours. France finds a large part of her productive territory in the enemies' hands, and has necessarily to convert her remaining factories as rapidly as possible to war production, to make her industrial power of manufacture fit her situation.

The United States, though possessing the greatest steel industry in the world, finds only one real reason for cutting down automobile production—and that is shortage of steel! The reasons of course are the enormous demands being made upon us not only by our allies for steel for war purposes, our own military, naval and shipbuilding program, but the sore need of a certain amount of steel for strictly peace purposes, to deny which is to halt industry, cripple finance and upset the economic balance already sufficiently disturbed by war.

A Fighting Industry

No one, as far as can be ascertained, is doing any protesting that the American motor car industry is compelled to cut down its output and put up its prices. There is no other industry in the country which does not similarly suffer, unless—and here is the cardinal argument—unless it is a non-essential one. Those industries which are not essential to war, and which do not hook up with the war program, could probably run along as usual, if it wasn't for sufficient wisdom in high places which will make them "work or fight."

But the motor industry is already fighting. It was the motor industry which produced the Liberty Motor. It was the motor industry which produced the several sizes of war trucks. It was the motor industry which has produced the thousands of motor cycles and side cars used by the army. It is the motor industry which is engining hundreds of coast patrol boats. It is the motor industry which has made possible the modern war front transportation of supplies, food, munitions, men, wounded and fresh troops.

But the motor industry has further claims to consideration as an absolute essential to American economic life than its contribution to war work. It is not the motor plant which has been transformed to a shell making plant or a gun making plant or other strictly war supply plant which is to be regarded as its bulwark against extinction. It is, first, the work it accomplishes as a finished entry, and second, the inter-dependence of a hundred allied industries on the motor industry, which makes it as absolutely an essential to American financial stability and economic progress as the coal, steel and railroad industries themselves.

Magnitude of the Automobile Industry

As a car must be made before it can be used, let us look first at the size of the American industry. In the first place, it is not a mere collections of factories housing machinery, and working on steel. It buys and pays for the products of many mines—iron, copper, aluminum, zinc and lead. It uses the product of many chemical makers. It draws upon the ranch for hair and hides and glue and keeps canneries busy. Through textile mills it lays toll on the sheep ranch, and the wadding and the thread makers, the tire makers and the cover makers demand much of cotton plantations and rubber plantations. The lumber camps supply the planing mills and the planing and paper mills get paid large amounts by the automobile industry. Sand pits, oil wells, stone quarries, clay pits, glass works, oil refineries, cement works and brick kilns, are all selling to the automobile plants. Take those plants out of the economic system and you disrupt the whole fabric of this country's balanced industry.

It is idle to say "England did it." England *had* to do it. We *could* get along without anything if we had to—but when we do, we are by so much less efficient. And we don't want to be less, but more efficient, in the winning of this war.

In the United States last year there were very few if any less than one million workers engaged in automobile making, parts making, body making, accessories making. There were probably another million—at least a huge number—in repair shops, garages, service stations, oil distributing stations, etc. The wages paid in the factories which make cars only, amounted to $275,000,000, more than a third of the entire capital invested in car factories—$736,000,000. If all these people and all this money are engaged in a non-essential industry, we

(Concluded on page 198)

Tricks and Acrobatics of the Air Fighter

What a Pilot is Taught at the French Finishing School

WERE speed the only criterion by which to judge the most likely winner of an aerial combat, then the aviator mounting the fastest machine would always be the victor. And that is as much as to say that the Allied aviators would always win, because of late their machines are almost always faster than the German ones. But speed and climbing ability are only two factors in aerial combat; besides, there are marksmanship and maneuvering skill. It is safe to say that the last-mentioned factor, maneuvering skill, is by far the most important in aerial combat. Both when on the offensive and on the defensive the aviator who knows every trick of his profession stands the best chance of winning or escaping.

It is due to the fact that tricks are an indispensable part of the air fighter's training that only the best of aviators are chosen for combat work. Indeed, as the training progresses from the safer to the more dangerous trick machines, more and more students drop out and are used in other branches of the air service, such as for reconnaissance and bombing work. The pick of the men—the daredevils, if you please—remain.

In the French flying service the combat or *chasse* pilots are sent to a finishing school at Pau, after graduating from preliminary flying schools. At Pau, under the direction of none other than Lieut. René Simon, who will be recalled as the daring exhibition flier of the early days of aviation in the United States, the pilots who have already mastered flight on slower mounts are put on diminutive but speedy Nieuport biplanes. From the Nieuport with a wing area of 18 square meters, the pupil advances to the 15-meter and finally to the 13-meter. Needless to say, the diminishing wing surface makes for greater speed, but at the same time the machine becomes more difficult to fly because of its poor gliding qualities. Such a machine lands at a terrific speed, and not as the larger planes which can volplane gracefully with their motors barely turning over.

Individual instruction is given at the Pau school of aerial acrobatics. Lieut. Simon explains the "stunts" one at a time to each student, who must repeat the instructions until every movement is committed to memory. Then the student takes the air with his diminutive biplane and performs the "stunts" with the instructor and other pupils watching on.

Now the greatest of all "stunts" appears to be the so-called "vrille," which is a sort of twisting or corkscrew tumble as of a machine falling out of control. It used to be the practice to teach the "vrille" last, but now it is taught first. For once the student has tried to master the "vrille" he no longer has fear for other "stunts."

To make his first "vrille," the student ascends to a height of over 800 meters and after flying on a level course for a short while, he switches off his engine and at the same time pulls the control stick back towards him and towards one side, while pushing on the rudder bar either right or left with his feet, depending on which side the control stick was directed. As a result the biplane swoops upward, loses its speed, stalls, and then falls over to one side with a twisting or corkscrew movement like a falling leaf. The sharpness of the movement can be varied according to the rudder pressure being utilized.

To come out of a "vrille" the pilot replaces his control stick in the center position and brings the rudder bar back to normal, and then pushes the control stick forward a few inches. The machines soon ceases to corkscrew, points forward, and dives straight down. It is then by reversing the control stick that the pilot brings the machine to an even keel again and switches on the engine. The "vrille" is done to the right and the left, while the ever-watchful Lieut. Simon waits for the pilot to land, in order to comment on the performance. Only one machine is in the air at a time.

The "renversement" comes after the "vrille." This trick is a change of direction without loss of height and, in the case of a skilled pilot, without reducing speed. The pilot ascends to above 800 meters and after flying on a level keel for a few minutes, he points the machine slightly down so as to bring the speed up to maximum. Then he brings the control stick back about half way and reduces the motor speed in order not to perform the "stunt" too rapidly. Then, when the machine appears to lose some of its speed the rudder is turned sharply to one side and the machine immediately falls to that side. When in the vertical position the airman brings the rudder to the center position, opens the engine wide, and returns the machine to a level keel. It will be noted that in the "renversement" the ailerons are not employed, as contrasted with the "vrille."

When being pursued a pilot sometimes resorts to the trick known as the "changement de direction" in French aviation circles. As in the instance of the "renversement," this turning maneuver can be executed without loss of speed or height. In describing this "stunt" in a recent issue of *Flying*, Lieut. Granville A. Pollack, U. S. A., late of the Lafayette Corps, states that it is a valuable but rather rare maneuver.

Flying level at full speed, the necessity to return suddenly is met by throwing the control stick very quickly to one side, as far as it will go, and then immediately pulling hard back toward the pilot, accompained by a very slight pressure of the opposite foot and only just sufficient to hold the tail level, or it will be inclined to fly forward. The result is very startling for the first time, for the pilot feels as though he were being forced through the seat, so strong is centrifugal force acting, yet in reality he makes a comparatively wide bend, not unlike a hairpin. This "stunt" is also done three or four times and either to the right or to the left, at the acrobatic school for airmen.

A wing slide follows, which is done by throwing the control all the way to one side, and accompanying it by pushing the opposite foot sharply ahead, sufficient to hold the nose of the machine up, and at the same time slightly pushing forward the control stick, which gives the effect of traveling on the "outside" of the circle, and the machine descends sidewise at a terrific speed, much faster than it goes ahead, but with the pilot following practically a straight course forward.

A fifth trick, that of "retournment," is performed, very similarly to a "renversement," but instead of coming out in the opposite direction the movement is continued until one is again on the original course. To commence, the pilot does as in the "renversement," pulling the control stick back, the machine mounting sharply, and giving the rudder a kick. Then the tail goes up as the machine starts to fall to one side; but now, as the position approaches the vertical, the foot is only partly recovered, while the control is pulled moderately to the same side, as used by the rudder, which produces a half spin sufficient to bring the machine back to the former direction. It is important that the aileron should be used here, for if the rudder alone is used the movement will be too slow to be of value in a fight, and will result in loss of considerable height.

Here it should be understood that, when done properly, all these maneuvers, excepting the wing slips, should be done without appreciable loss of height, and therefore quickly; and so as an indication of the development of a pilot's "reflex," aerial acrobacy is beyond doubt conclusive evidence.

Last, and by far the most difficult to execute, is the horizontal "vrille" or barrel roll, as it is often called, which is very spectacular but the use of which in combat is questionable. This is usually started by slightly reducing the speed of the engine, pulling the control stick well towards the pilot, and giving a very quick push at the rudder—to the full extent, in fact—and at once replacing all controls in the center. The machine starts to mount suddenly, but the full effect of the rudder swings the machine up on one wing, over complete sideways, which follows with a wing slip and a flattening sidewise. The whole presents a most striking effect, and unless the pilot is quick it generally results in a loss of speed and a "vrille."

Looping is not encouraged in military aeronautics, for the reason that as long as the machine is inverted the pilot is helpless and presents a good mark to his opponent. Furthermore, the machine guns are apt to jam as a result of the maneuver.

A "stunt" frequently employed at the front is the upward swoop followed by a tail slide. When a machine is being pursued by another which is blazing away at the tail of the first, the usual maneuver for the first pilot is to pull the control stick backwards, heading his machine straight up until it attains a vertical position. Here it "hangs" by its propeller for just an instant, as is strikingly shown in our cover sketch, when it slides back and is finally brought into the level position again. Now it is behind the opponent and possesses the advantage.

Correspondence

The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.

The First Transatlantic Telephonic Transmission

To the Editor of the SCIENTIFIC AMERICAN:

I am preparing a short history of wireless telephony, and having been for some years out of touch with this line of work, am unable to obtain certain rather important data relative to the history of the Art. Since the SCIENTIFIC AMERICAN reaches so many thousands of engineers it has occurred to me that the information might be obtained if you would be so kind as to publish this letter of inquiry with the statement that I should be extremely obliged if those engineers having the information at their disposal would please forward it to me.

The first point in regard to which information is desired is this:

About November, 1906, my Brant Rock, Massachusetts, and Macrihamish, Scotland, wireless stations were in operation, and we were working mostly "G" tune, frequency 70,000 cycles per second, to avoid daylight absorption.

We shut down for about a month at this time to make some change in the sending apparatus of the Macrihamish end, but continued sending occasionally from Brant Rock, though most of the time at Brant Rock was spent, while waiting for Macrihamish to be completed, in installing and testing our new wireless telephone system between the station at Brant Rock, Massachusetts, and a station at Plymouth, Massachusetts, about twelve miles away.

Meantime the operators at Macrihamish were listening regularly every night to other stations, partly for the purpose of keeping in practice and obtaining data as to atmospheric absorption, etc., and partly so as to be sure to get any messages which might be sent from Brant Rock, as we were using wireless exclusively in order to save cable expenses. Practically all the listening was done on "G" tune as we had shortly previously made our very important discovery, later published in the *Electrician*, that while the absorption increased with increased wave length up to about 100,000 frequency, beyond that point the absorption fell off very rapidly as the frequency was decreased until at about 70,000 frequency the absorption was comparatively small.

Sometime, I think, in November, 1906, I received a registered letter marked *Personal* from one of the Macrihamish operators. In this letter he stated that he had been listening in on a certain date, which he specified, and at a certain hour, about four o'clock in the morning as I recollect it, and had noticed a remarkable phenomenon which showed that speech could be transmitted by speaking in proximity to the rotary spark gap (we were then using 10 kw. rotary spark gap, giving about 500 or 1,000 sparks per second). He stated that at the date and hour specified he had heard one of our Brant Rock engineers giving instructions to one of his assistants in regard to the running of the dynamo; that the speech had come in very clear and plain, and that he was able to identify the speaker as Mr. Stein (now, I believe, with the Bell Telephone Company); he wrote out in detail the words which he stated he had heard Mr. Stein speak to his assistant, as he had written them down after hearing them; the whole amounting to five or six sentences totalling between fifty and one hundred words.

He stated that he had not reported this to me by wireless because other stations listening in might have got the report and he considered it too important to run any risk of premature disclosure. He also stated that he was sending it by special registered letter for the same reason.

My first thought was that the operator had made some mistake and that possibly some experimenters in England had also been working with my wireless telephone, since the patent disclosing the invention had been issued some years previously, and we had given a number of demonstrations of the telephoning operation.

However, I called in Mr. Stein and repeated to him the instructions which the Macrihamish operator had overheard Stein giving to his assistant, and asked Mr. Stein if he had given any such instructions to his assistant in the Brant Rock station. Mr. Stein stated at once that he had not given any such instructions to his assistant in the Brant Rock station and that the instructions so given did not relate to any of the apparatus in the Brant Rock station, but related to the motor generator set for driving the high frequency telephone are at the Plymouth station. I asked Mr. Stein when he gave the instructions, and he said he did not know, but could tell by looking up the station log, which he did and reported that they were given on the night of a certain date, between certain hours on that night, those hours being the hours as shown by the station log between which tests were being made which would require such instructions being given.

The date and hours given by Mr. Stein, without knowledge of the date and hours given by the Macrihamish operator, coincided exactly, after allowance had been made for the difference in time between Macrihamish and Brant Rock, with the date and hour given by the Marcihamish operator, and it became evident at once that what had happened was that the Macrihamish operator, listening on "G" tune which was the same frequency used for working telegraphically between the Brant Rock and Macrihamish stations and the frequency used for working telephonically between Brant Rock and Plymouth, had overheard Mr. Stein at the Brant Rock station giving instructions by wireless telephone to his assistant at the Plymouth wireless telephone station.

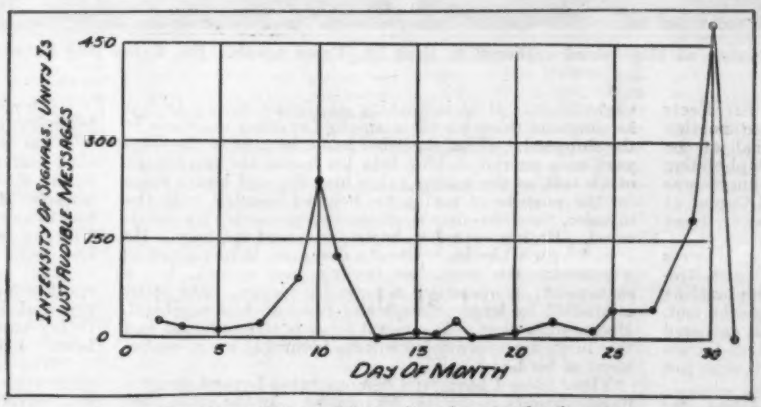
In this connection I would say that the Macrihamish operature's conjecture that speech transmission was due to the fact that Mr. Stein was standing near the rotating arc gap when giving his instructions, was formed without his knowing that we had just received our first high frequency generator which had been built in our Washington shops (I may say that this high frequency dynamo giving about ½ kw. at 70,000 cycles, a photograph of which appeared in the *Electrical Review* for February 15, 1907, was still in good condition last year after ten years' service though not so efficient electrically as the larger sized high frequency dynamos later so admirably designed by Mr. Alexanderson and built for us by the General Electric Company).

The Macrihamish operator's theory that speech might be transmitted wirelessly by speaking close up to an arc was aside from its ingenuity by no means unsound for I later made some experiments to test this point and found that under certain conditions, and with the arc at a certain adjustment, speech could actually be so transmitted, though the articulation was not good enough for commercial work.

The reason why the operator did not get the talking every night will be seen from examining the curve showing variation of intensity of transatlantic messages for the month of January, 1906, published in the *Electrical Review*, May 11, 1906, and reproduced herewith.

From this curve it will be seen that during the month of January the average intensity of the messages was less than five time audibility, but that on five nights, *i. e.*, January 9th, 10th, 11th, 29th and 30th, it was above 100 times audibility; on one night, January 10th, it was 225 times audibility, and on one night, January 30th, it was 500 times audibility, the signals on these latter two nights being so loud that they could be heard all over the receiving room with the head phones lying on the table. This curve of intensity of transatlantic wireless transmission was made with the 10 kw. telegraph set referred to above. Consequently since the 70,000 cycle alternator only gave ½ kw., the intensity of telegraphic signals received from it would only be 1/20 as strong, and consequently would only be heard on the five nights on which the intensity was more than 20 with the 10 kw. set.

In addition to this, however, telephonic transmission



Curve showing variation of intensity of transatlantic messages in January, 1906

is not so efficient as telegraphic transmission, *i. e.*, it takes more power to telephone wirelessly a given distance than it does to telegraph wirelessly. In my paper on Wireless Telegraphy, (American Institute, Electrical Engineers, June 29, 1908) I have given the ratio experimentally determined as 10:1, for good telephonic transmission. Assuming this ratio, we see that telephonic transmission could only be accomplished across the Atlantic on those two nights, January 10th and 30th, on which the transmission was more than 200 times audibility, and consequently it was only a few days during each of the winter months that the Macrihamish observer was able to overhear the telephonic transmission between Brant Rock and Plymouth.

After ascertaining these facts, I decided to give a demonstration of transatlantic wireless telephony at the earliest possible moment, and pushed forward the construction of the new 1½ kw. generator which was being designed for us by Mr. Alexanderson.

About a week or ten days later, I received a second letter from the Macrihamish operator, stating that he had heard the talking again, giving dates and times and record of the words said, and urging that I take up the matter at once. A program of transatlantic telephonic tests was drawn up, and arrangements were made to carry out a series of telephonic tests between Brant Rock and Macrihamish, when unfortunately owing to the carelessness of one of the contractors employed in shifting some of the supporting cables of the Macrihamish (as described in the *Engineer*, January 18th and 25th, 1907), it fell down on December 6th, 1906.

No publication was made at the time of the results of these two pioneer instances of transatlantic telephonic communication because prior to and at that time there had occurred a considerable number of instances where entirely false claims had been made in regard to transatlantic working, and some which the writer had had a hand in exposing; for example, the false claim that messages had been transmitted across the Atlantic to Newfoundland, and any statement made that telephonic transmission had been accomplished across the Atlantic would have been looked upon with incredulity especially in view of the fact that Macrihamish tower had fallen down, and hence no confirming demonstration could be given.

It was therefore decided to wait until the Macrihamish tower had been rebuilt, and then give a public demonstration before making any public reference to these facts mentioned above.

The Macrihamish tower was, however, never rebuilt, and consequently the public demonstration was never given.

A history of wireless telegraphy and telephony such as the one which the writer has at present in preparation, would, however, be incomplete without reference to these facts, and as I have been so long disconnected with wireless telegraphy, and am not able to obtain the correspondence and records relating to this matter, I should be very much obliged if any of the readers of the SCIENTIFIC AMERICAN who may have possession of the facts would please write me.

a. What was the name of the Macrihamish operator who notified me of these two pioneer instances of transatlantic telephonic transmission?
b. What were the dates and times at which they took place?
c. Is my recollection correct that it was Mr. Stein whom the operator overheard giving instructions to his assistant?
d. Who were the operators in Guantanamo, Panama, and Nebraska (or was it Michigan?), who wrote me about that time that they had overheard our telephonic work between Brant Rock and Plymouth, giving dates and times?

In addition to the above, I should be very glad to obtain information in regard to the following other points:

1. In what publication or publications and on what date did the writer's first description of his system of telegraphing by pure sine waves without making or breaking the circuit, appear? The first test was made in 1892 at the Standard Laboratory and later continued at Purdue and Pittsburgh Universities, and in some place a full description has been published of the apparatus, which description I have been unable to locate.
2. In what publication and on what date did the writer's description of his resonance analyzer appear? This was a system of parallel tune circuits, tuned to different frequencies, used for analyzing complex periodic functions. It was built by Queen & Company for the writer about 1901, and the publication describes its application to the measurements of the frequencies of static disturbances at different hours of the day, and their relative intensities. Though it has since been superseded by the heterodyne analyzer, it is not unimportant historically.
3. Who were the students at Purdue who in 1892–93 carried out the tests on the writer's hot wire anemometer and is any copy of this thesis still in existence?

Any information in regard to the above will be most gratefully received.

REGINALD A. FESSENDEN.
185 Franklin St., Boston, Mass.

The Sense of Smell in Insects

To the Editor of the SCIENTIFIC AMERICAN:

In a recent issue I noticed an article on "Smelling Power of Insects," where writer states that while crossing a plain upon which no tree or grass was visible his companion upon having nose bleed and allowing blood to flow upon the dry earth, saw blow-flies appear in a few seconds, attracted by the smell.

On a level plain in hot, clear weather one should be able to see at least ten miles or say eight miles from the level of eyes of observer on horse-back. The idea was given that being no grass there could be no flies thereabout.

Granting that there was a slight wind it would take more than one minute for odor to travel eight miles at least, but allowing smell to reach a blow-fly eight miles away instantly how on earth could he fly eight miles in 15 seconds as writer stated?

If said fly had collided with him he would surely have been bored through and through.

I hold that it all occurred as stated, but proves that there are insects all about waiting for business aans trees, grass, or other shelter.

CHARLES M. GREEN.
Bedford, Ohio.

Celluloid Inlays for Deformed Noses

SURGEONS are frequently called on to repair noses that have been broken or otherwise deformed through the loss of some of the bone needed to support the nasal tissues in shape. The practice has been to replace the missing bone with a piece of cartilage cut from a rib, which made the operation very complicated.

However, one of America's greatest surgeons undertook to simplify this operation by using strips of a material which is a form of celluloid largely used in the manufacture of toilet articles, in place of cartilage. He experimented first by inserting the strips in the noses of animals and found that they were a perfect inlay, remaining unchanged and in shape indefinitely. He has since repaired many human noses with perfect success.

His method of operating is to cut from a slab of the material a piece of about the size and shape needed. This is soaked in hot water, trimmed with scissors and perforated with many small drill holes. Then a pocket is cut in the nose from about where the spectacles would rest down to the tip, the insert is slipped in and the small wound sewed up. The nose soon becomes normally shaped and quite strong.

One Community's War Gardens

THE Illinois State Council of Defense estimates that the war gardens in the city of Chicago alone total 4,830 acres and are the result of the labor of 250,000 individual war gardeners. The value of the crop for the coming year is estimated at $3,500,000. This figure is backed up by details concerning the assumptions made, which seem to establish that the amount mentioned is a very conservative one. The Council suggests that in the immediate suburbs of Chicago at least ninety per cent of the vacant land is under cultivation, and that this land will produce a crop surely equaling, if not surpassing, that of the city proper.

Teaching the Worker to Feel the War

How the Men in the Shipyards Are Responding to the Spur of Patriotism

By Dr. Charles A. Eaton, Head of the National Service Section of the United States Shipping Board

A crowd of workmen at Hog Island gathered to hear Dr. Eaton speak. Dr. Eaton may be seen in the insert

ON a November evening in 1917, the Naval Architects and Marine Engineers of America were holding their annual meeting in the great banquet hall of the Waldorf Astoria. The leading men of the shipbuilding industry of America were there. Among the guests was the Honorable Josephus Daniels and Admiral Capps, at that time General Manager of the Emergency Fleet Corporation.

The meeting was marked by a spirit of seriousness amounting almost to depression. Sudden and tremendous calls had been made upon the shipbuilding resources of our nation, and these calls could not be met. The reason, as understood by the men there gathered was that the workers in the shipyards of America did not understand the gravity of the situation and were not producing to the full extent of their ability.

I was the last speaker on the program. I had prepared an address dealing with what I thought ought to be the solution of this most difficult situation. To my astonishment the entire company welcomed what I had to say as a possible answer to their problem. Before the meeting ended Admiral Capps had commandeered me to go into the shipyards of the country and put into practice the theory which I had outlined.

The next morning I met Admiral Capps by appointment and together, with other officers of the Emergency Fleet Corporation, we went to Staten Island. On one of the new ways of the Downey Shipbuilding Corporation, we held our first meeting. Mr. Downey and Admiral Capps agreed after the meeting that we had found the solution of the problem.

It was after the first of the year before we could take up the matter in an organized and efficient way. Then there was organized, under the direction of Mr. Charles Piez, Vice-President and General Manager of the Emergency Fleet Corporation, the National Service Section, of which I was appointed head and which has ever since been carrying out the program as outlined in the November meeting of shipbuilders in New York.

This bare recital of facts contains within it an extraordinary departure from the established principles and methods of industry. For the first time in the history of the world a great commercial undertaking was frankly founded upon spiritual forces. It was and is still the opinion of Mr. Piez, as it is still my own, that the measure of a man's productive power is the quality of spirit which he brings to his task. If a man comes to the shipyards as a mere machine, he cannot produce either in quality or quantity as much as he ought to do. If he is working simply for money he is a hireling and takes his place among the other machines of the shipyard. If, on the other hand, he goes to the shipyard as a patriot, taking into his hands the implement of his toil, as the soldier takes his rifle, and builds ships for the purpose of saving his beloved country from the invader, then the man's efficiency approaches its maximum. He has ceased to be an industrial machine. He is no longer a hireling. He is a free man; a moral agent; a patriot. His work has become, not a task, but a sacrament; a ministry; a patriotic service. His spirit is kindled by large principles of freedom and manhood. His mind is alert. His moral force is strengthened and this inner transformation affects favorably every movement of his body.

These ideas I have seen demonstrated beyond doubt a hundred times in the last six months. In the great Fore River plant at Quincy, Mass., we held a meeting in February attended by eight or ten thousand men. The thermometer registered 17 below zero. In spite of that it was a warm meeting. At the close of the meeting a fine specimen of shipworker barred my pathway as I came down from the platform. He looked belligerent.

"Who do you think you are looking at," he inquired.

I answered him, "I am looking at a very fair specimen of a New England shipbuilder."

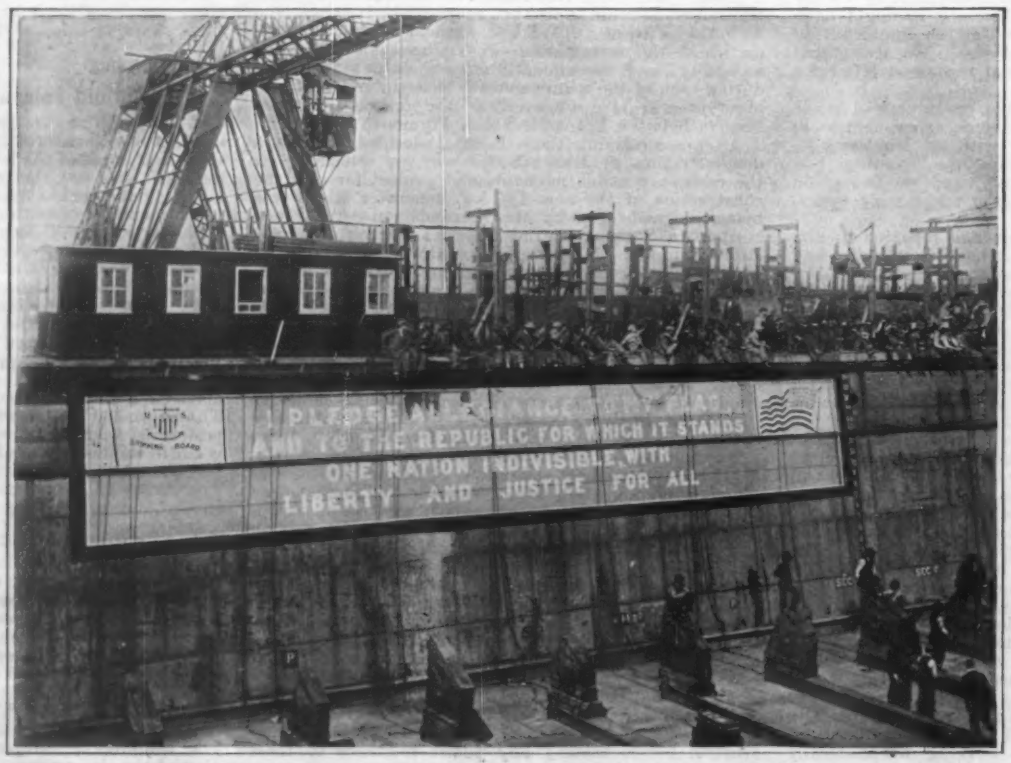
"You are not," he replied, "you are looking at a plain, ordinary, garden variety of a damn fool."

I was interested. Most of us achieve this at some time and some of us achieve it often, but we hate to admit it. This gentleman at least was honest with himself. I waited with curiosity to discover what he had to say further. He began to cry, and then he said: "I have been a shipworker for 24 years. I have only two boys. I love them. Both of them are at this moment in the trenches in France. Until I heard you speak a few minutes ago it never entered my head that my work in this shipyard could be of any possible help to my two boys in the trenches. What a fool I have been! I was away last week three days from my work.

"Why sir," and a great sob welled up from his throat, "the work which I failed to do in those three days might have saved my boys' life. Without realizing it, I might have killed my own sons."

He turned and walked away, and as he went, he looked back over his shoulder and said, "You watch your Uncle Dudley from now on."

This gentleman had suddenly become a rational moral agent. He was getting down to brass tacks. The intoxication of Bolshevikism, which looks upon work as the devil is supposed to look upon holy water, was suddenly blown out of his system. He had become an American citizen again, a free man and he had discovered that no man has a right to be free unless he is prepared to pay the price of freedom. In this man's case that price was work. In the case of his two sons it was fighting with weapons. In both cases they were soldiers; over there in the first line; here in the second line of defense.



The workmen's pledge painted on the side-launching ways of a Great Lakes shipyard

My first round of the shipyards was one of the most encouraging experiences of my life. I found the men to be simply a cross section out of American life. They were no better and no worse than the rest of us. Some of them were slackers, but we have an abundance of slackers in every walk of life. All of them were selfish, just like the rest of us. Few of them had given any serious thought to their citizenship. It had never occurred to the majority of them that being an American citizen laid any moral obligation upon a man almost equal to that involved in the Kingdom of God. We had been drifting downstream with our eyes shut; sidestepping hard things had become the great national sport.

The unique characteristic of the Christian religion lies in its innate power of self-regeneration, and this to my mind is the chief glory of democratic citizenship. At

the very moment when we seem to be approaching the abyss there emerge those hidden energies which all the while have been at work underneath the surface preparing us for a new era of greatness, efficiency and labor. I found that all the men of the shipyards needed was to know. They responded to our appeal with remarkable enthusiasm.

I have personally spoken to three-quarters of a million of men all over this nation in the shipyards and industrial plants during the first six months of this year. During the month of July the National Service Section through its corps of speakers addressed 1,100,000 men. We have yet to record the first instance of discourtesy on the part of the working men towards one of our speakers. This speaks well for the speakers and it speaks well for the men.

The psychology of the shipyards changes almost from day to day. We found at first that the men did not know what Germany was doing. Like all the rest of us, they had been doped by German propaganda and even after we had been in the war ourselves for months German spies and propagandists were at work among them.

Wounded soldiers from the trenches, representing Canadian, British, French and Italian armies came and told their stories. We placed these men on the stand as witnesses for the plaintiff. Their statement of actual fact was always followed by an interpretive address given by some civilian.

In the Standard Shipbuilding yards on Shooter Island a little New York boy of meager education and no oratorical gifts stood facing 3,000 shipworkers. He had gone to Canada from this city and enlisted in one of those wonderful Canadian regiments. Three times he had been desperately wounded. Invalided home, he wore upon his sleeve the stripes which showed the number of his wounds. He stood before that great crowd of shipworkers and told them his story.

As he finished an aged laborer leaped upon the platform and clasped the lad into his arms. Speaking in broken English he said "I am French. My son is in the trenches today, fighting for France. You make me think of him."

Then stooping the old man lifted the sleeve of the young soldier's uniform reverently to his lips and kissed the three stripes which signified honorable wounds.

Not a man in that crowd of hard-handed workers but knew what they were looking at as they witnessed this touching scene and the results of their thought and feeling were manifest almost instantly in increased output.

I have recently returned from the Pacific Coast where during the month of July, in company with Mr. Charles M. Schwab, Director General of the Emergency Fleet Corporation, Mr. Charles Piez, Vice-President and General Manager and Mr. C. W. Cathell, General Counsel, we visited the shipyards of the three Pacific states. Everywhere the reception was the same. Shipyard bands met us at all hours of the day and night at railroad stations to escort our leaders to and from the train. Everywhere when Mr. Schwab appeared in the shipyards the men welcomed him with a great shout of friendship. Everywhere they pledged without reservation to stand by our Government and our country, as good soldiers, until the war is won. That these were no idle words is shown by the fact that on San Francisco Bay alone, on the Fourth of July, there were launched 17 great ships.

In the Alameda yard the "Defiance," a ship of 12,000 tons went down the ways, having been built in 38 days. As the great hulk slipped towards the bay, she was followed by an immense crane lowering the keel of her successor. Then and there the men pledged Mr. Schwab that they would build this successor in 28 days.

As head of the National Service Section, I have visited the shipyards of this nation, north, south, east and west. I have come into contact with great masses of citizens in every section of the land and I am convinced that at this moment there is flowing, like a great Niagara, a flood of dedication which will bear upon its bosom our Government until this war is won. The masses of American men and women are determined that Germany shall be beaten. They will keep nothing back in sacrifice or service until this is accomplished. This attitude is not emotional; there is no hysteria. It is the calm, deadly, reasoned attitude of free moral beings, who see a murderous, brutal tyranny threatening to ruin the world; and who are determined to take hold of this hated thing and break it.

Copyright, Kadel & Herbert

British driver fitting gas masks to his team before entering the battle zone

There are certain facts about the shipbuilding program which every American ought to know. First as to the quality of leadership which the Government has been fortunate to secure in the carrying out of this greatest of all programs. At the head of the Shipping Board stands Mr. Edward N. Hurley, who throughout the strain and vicissitudes since he assumed that position has held on his way, braving public opinion, inspiring shipbuilders by his appeals, straightening out labor difficulties, and, with an unwavering loyalty backing up the President of the United States to the full extent of his power. With Mr. Hurley stands Mr. Charles Piez, Vice-President and General Manager of the Emergency Fleet Corporation—the $50,000,000 corporation which is charged with the task of producing the ships we need. Mr. Piez has done a work which entitles him to the ungrudging gratitude and affection of the American people. A great engineer and executive, he enjoys the confidence of the employers and the workingmen alike. Calm, logical, absolutely just, he does not hesitate to tell the truth as he sees it, and this habit of mind has earned for him the confidence of the nation to a remarkable degree.

When, a few months ago, Mr. Hurley and Mr. Piez decided that we must have a supreme leader in ship production, there was only one choice, Mr. Charles M. Schwab, who is equipped for the position of Director General as is no other man in America or, for that matter, in the world. With the unerring judgment of men trained in self-government, the whole nation accepted the appointment of Mr. Schwab as the greatest event of a personal nature which has happened since we entered the war. From the greatest to the least, all are convinced that in Mr. Schwab we have a leader of sufficient courage, vision, experience, and resource to bring us safely through.

(*Concluded on page 198*)

The Battle of Poisonous Gases

IN all of their recent offensives the Germans have made extensive use of poisonous gases, both in the form of shell and in clouds. Indeed, it is practically necessary to admit that the Germans have developed a real gas strategy which has served them to good stead of late.

Piecing together the various reports coming back from the battlefront, it seems that the Germans have many forms of gas which they employ according to a definite set of rules. When the wind is favorable and a large area of enemy territory is to be soaked in gas, a gas cloud is sent over. In general, this gas cloud only extends to a height of eight or ten feet, so that a machine gunner located in the second story of a building is practically immune from the poisonous fumes. But gas clouds are soon detected by the Allied observers, and precautions are taken before the poisonous fumes can get in their deadly work. Still, surprises are effected at times; in some instances the trick is turned by sending over one cloud and then another an hour or two later, when the defenders are congratulating themselves on having come through the first. But in the main the gas cloud is not a very effective method, since the gas cannot be present in a strong concentration because of the distance it must travel before reaching the attacked positions. However, it serves a definite advantage in compelling defending troops to wear gas masks, thus placing them at a distinct disadvantage in manning their guns.

Mustard shell and other irritating gas shell, or lachrymose shell to use the technical term, are widely employed by the Germans and with good results at times. The fumes released by these shell have such a powerful effect on the eyes of the defenders that they are often rendered helpless. The less disciplined men have been known to tear off their gas masks when in contact with the irritating fumes, only to succumb to the deadly fumes present.

Gas shell are generally intermingled with high explosive shell during a bombardment, so as to catch the defenders off their guard. But so well trained are all the men in the war zone that at the very first suspicion of gas they don their masks in less time than it takes to tell about it. Thus casualties are kept down to a minimum.

Among the latest German gases are those of the ephemeral variety, which are fired in shell to cover certain positions. The gas is so timed that when the German attacking troops arrive the poisonous fumes have become diluted to the point where they are harmless to unmasked men.

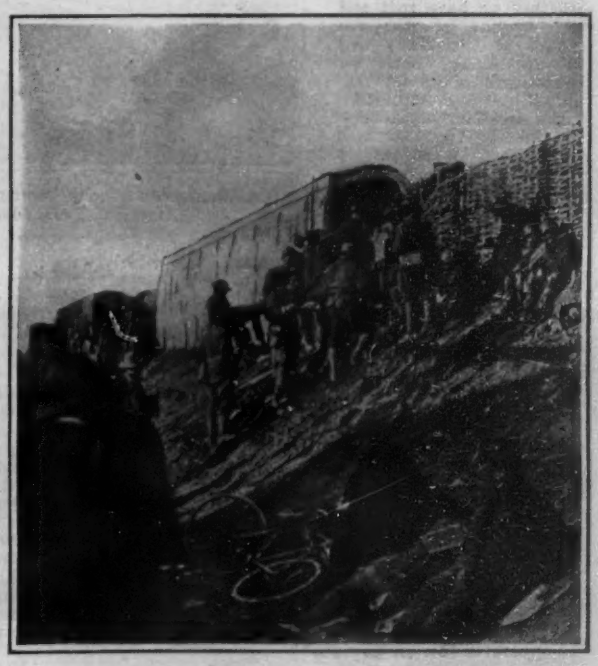
Gas warfare is a game at which two can play, so that the Allies must not be considered always in the light of defenders. Long ago they too became adepts at this form of warfare; and on more than one occasion the Germans have had good cause to regret having introduced this form of *schrecklichkeit*. Today it is an accepted form of combat; and the question is one of developing new gases and new methods of attack on the one hand, and developing better masks and better means of defense on the other. In brief, it is a matter of give and take, with emphasis on the "give."

Queer Defense Systems of Our Italian Allies

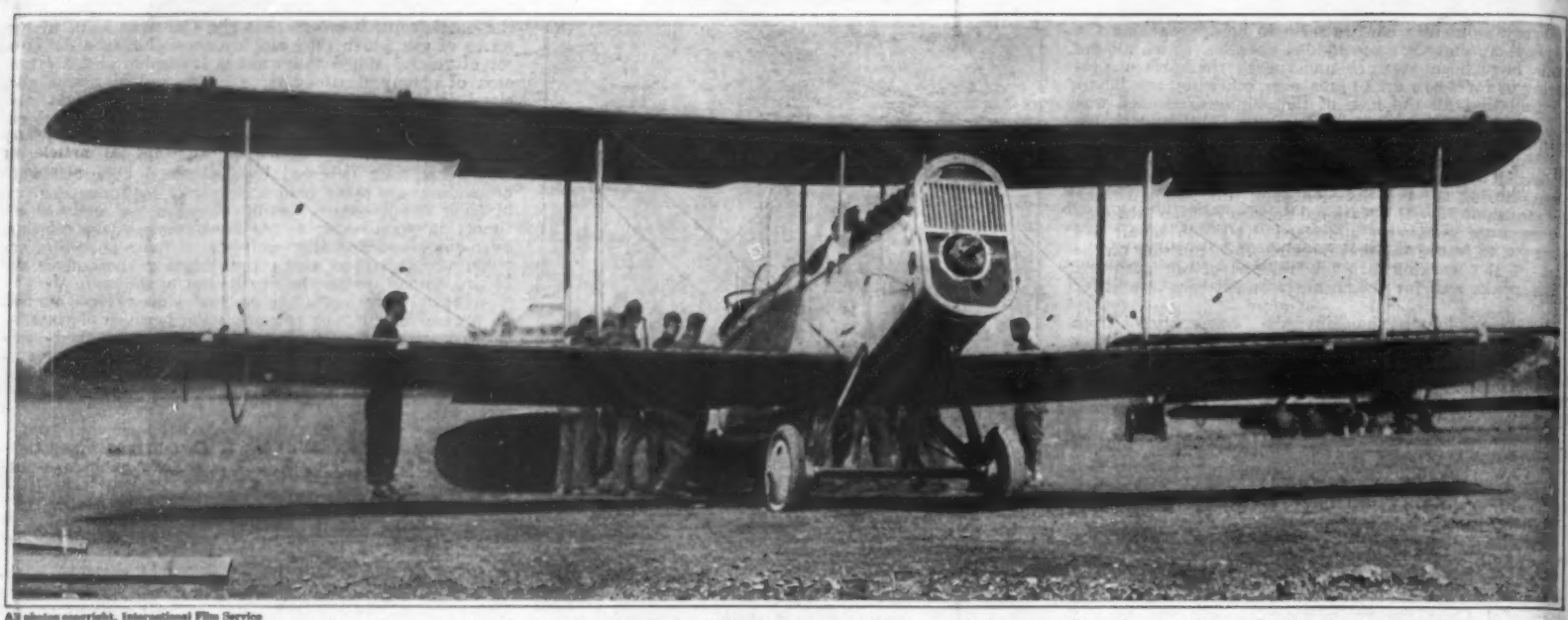
IN falling back from the mountainous front along the Isonzo River to the present line along the Piave, the Italians during the past nine months have had to make use of numerous improvised defenses, in some instances under the most unusual conditions of trench warfare. Indeed, when the Italians were obliged to fall back from the Isonzo heights, they constructed rough defenses as they fell back in the face of overwhelming numbers of Germans and Austro-Hungarians; and it was only by retreating as far as the Piave that the Italians gained sufficient time to dig themselves in properly so as to regain a better equilibrium between the contending armies.

In the case of the temporary halt behind the Tagliamento River, the Italians hastily threw up breastworks along one of the roads, as shown in the two accompanying illustrations. At regular intervals they provided the defenders with concrete tunnels or shelters, which served both as bombproofs and as huts for the soldiers. The rear of the breastworks was revetted with interlaced twigs. Now the peculiar feature of this defense works was its employment; for, as will be noted in the illustrations, it was used as a sort of trench in connection with the road. Thus it made for the least amount of digging and other physical effort in preparing the line for defense. Furthermore, the drivers and other traffic men, as well as the troops on the march, were enabled to make use of the concrete shelters if caught by enemy shell fire or enemy aerial raiders.

Hurriedly thrown up breastworks of the Italian armies along the Tagliamento River, during the October retreat of last year



A close-up view of one of the concrete shelters of the Tagliamento defenses



All photos copyright, International Film Service

One of the American DeHaviland Fours equipped with the 12-cylinder Liberty motor, which is now being turned out in quantity production in the United States

"The Wasters"—and Fair Play

Some Comments on the Congressional Investigation of the Aircraft Program

By C. H. Claudy

CONGRESS—or its investigating committee which has rendered a report on the Government's aeronautical program, its conduct and its results—has expressed itself to the effect that a substantial amount of the initial appropriation of $640,000,000 has been wasted.

"Some wasters"—these gentlemen who are responsible!

There are few questions which have not two sides. In America we are taught from the cradle that fair play demands hearing both sides before we render judgment. We give every prisoner at the bar the right to be heard in his own defense, and we call no man guilty until he is proved so. But we don't carry the principle into Congressional investigations, for none of the officers or civilians who are concerned in this matter can get up and tell their side of the story—first, because in the case of the officers, it would be a military offense subjecting them to court martial, and second because to do so would be to give Germany exactly the real information she wants. This Congressional report ought to be a lot of comfort to Germany, but if it misleads her, it will do no real harm. *All* the *facts* might be of some real service to her.

Lest some one think this is an argument dragged into light in lieu of a better one, a quotation is here included from the War Cabinet Report of Great Britain, for 1917. It states:

"In endeavouring to describe the measures taken to meet the aircraft needs of the Navy and Army, the writer is at once confronted by the fact that the information desired by the country is precisely the information desired by the enemy. What the country wants to know is what has been the expansion in our Air Service; whether we have met and are meeting all the demands of the Navy and of the Army, both for replacement of obsolete machines by the most modern types and for the increase of our fighting strength in the air; what portion of the national resources in men, material and factories is being devoted to aviation; what the expansion is likely to be in the future. These are precisely the facts which we should like to know with regard to the German air service, and for that reason it would be inadmissible for us to supply Germany with corresponding information about ourselves by publishing a statement on the subject."

Obviously this wasn't written in England just because some one had nothing else to do. Equally obviously, it is not quoted here merely because it is the *only* defense of the aircraft program and those behind it, but because it is a reasonable and logical excuse for a failure to make any defense, even by those civilians concerned who might easily be provoked into doing so by the obvious, if sincerely conceived, injustices in the report.

But if the service cannot speak for itself, many who know some of the facts will speak, and already there is a "backwash" in the daily press which is beginning to ask "What do legislators, no matter how honest or hard working, really *know* about digging into a matter as highly technical and as little understood as quantity production of a highly complicated and scientific piece of apparatus like an airplane?"

Cradle mounting for the rear machine gun of the American DeHaviland Four

How the Liberty engine is installed in our DeHaviland Fours

The Liberty Motor

The report condemns the program because it centers about the Liberty motor. That motor is spoken of as if it were one lone article, designed for all types of air craft, from a single seater fighter to a night bomber. Of course, such a thing is an absurdity. The Liberty engine has been designed in four, six, eight, ten and twelve cylinders, to be applied in various weights and various powers to various machines. But that it was not considered or supposed to be the only engine—merely the only engine which in several sizes could be produced in huge quantities quickly—is not a matter for discussion. It is a matter of fact. We have produced Hispana-Suiza, Gnome, La Rhone and Bugatti engines. We have produced 4,742 elementary training planes (to July 26th) of which those "in storage on account of danger" will all be utilized with safety. We have produced 1,421 advanced training planes, 967 combat and bombing planes, 8,790 elementary training engines (Hall-Scott) 2,975 advanced training engines (Hispana-Suiza, Gnome and La Rhone), 3,513 Liberty Twelves, and four Hispana-Suiza 300 h.p. engines, a brand new development.

We have manufactured 26,248 propellers, 29,000 machine guns for aircraft (all shipped by July 26th) and instruments by the thousand, instruments without which an airplane is as ineffectual as a motor car without an oil indicator, a speedometer or an electrical indicator.

Does this smack of waste? Especially $640,000,000 waste?

A New Industry Built in a Year

When we started we had, literally, *nothing*. There were less than a hundred aircraft owned by the United States. There was no industry whatever. A few concerns were producing aircraft as the colonial furniture builders produced chairs and tables—by hand, handicraft and personal skill. A few others were doing experimental work. But there were no factories, there was no organization, there was no raw material market, there were no training schools, no instrument factories, no anything.

This was the condition a year ago. And the answer is fundamental, and not all the Senatorial reports in the world can alter it—the condition shows whether the money was wasted or whether the aircraft program is a failure or not. Today there is an army of over 150,000 men working on aircraft and aircraft parts and accessories. There are 248 factories making planes, parts and accessories. This is not counting sub-contractors, which if they are lumped in, brings the total of plants well over 400. There is an army of more than 157,000 men in the air service, as entirely distinct from those in production. We have designed, tested and put into production a motor which is today so much the marvel of the foreign flying man, that we can't begin to supply them fast enough. We are now getting about 2,400 Liberty engines a month—more than the capacity of the greatest British air craft engine plant for a year. In less than a year from now we will produce more than 60,000 Liberty engines of which England has already ordered 22,000.

We have shipped abroad 11,000 tons of raw materials, *not* including spruce, and mechanics to work the raw materials into planes in France—because we can ship materials and men more easily than we can completed planes. We have ordered abroad and used to date something like 8,000 planes—foreign planes, foreign built, for foreign use—because our allies insisted that we must have them in France before we could make them, and, on going over our program, said we would need that number before we could begin to get our own in quantities over on the Western front.

We have developed a cloth made from cotton which is as good as, if not superior to, linen for wings. We have shipped it in large quantities to our allies—had we not done so, their program in the air must have been curtailed.

There was no such thing as a "dope" factory a year ago. We have $20,000,000 worth of "dope" factories now working and are getting all the "dope" we need and even preparing to ship it to our hard pressed allies. If there be a Senator or a Sculptor or other aircraft program critic who doesn't know what "dope" is, let it be said that without it a plane can't be made. It is the material which makes the wings air proof and water proof.

We have an Army of 12,000 men in khaki cutting spruce for aircraft. Had it not been for our wood, our labor, our go-aheadedness, where would our allies be in their program?

But our critics see only the fact that our own manufacturing performance has not run to the schedule of promises and prophecy.

Great Britain's Experience

All of which brings one naturally to the question as to just what the blame which the aircraft program ought to shoulder really is?

Again let reference be made to the War Board Report of Great Britain. Their experience has so exactly dovetailed with ours, their critics have been so exactly on a par with ours in their incomprehension of either the problem or its solution, that it would be funny if it wasn't so serious a matter. The report states in part:

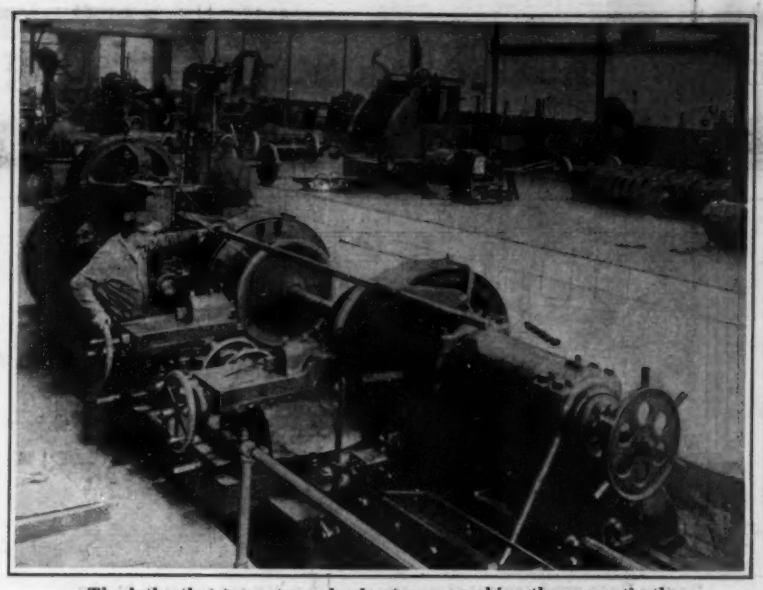
"It is rather the fashion to criticise the quality of our machines. Most of the critics however, are ignorant of the technical and manufacturing difficulties which have to be overcome in order to keep up a constant and increasing supply of the most up-to-date machines. Not only are the technical difficulties and the resultant research and experimental work formidable in themselves, but the task of building up in war time, without seriously affecting the requirements

(Concluded on page 199)

A Double-Barrelled Lathe

A MACHINE in use in some of our large trolley repair shops would seem to have inherent possibilities of wide application. The general idea is that of a lathe with more than one working point, all the cutting tools being controlled from a single center.

The particular problem met in the trolley shops is the re-turning of worn wheels. It is obvious enough that if the two wheels on the same axle are not turned to the same diameter within very narrow limits, there will be a ruinous rocking and racking action when they are put under a moving car. Instead of turning two wheels separately and testing them—by any one of a number of known methods any one of which would be satisfactory—the problem is reduced to its simplest terms by having two cutting tools, separated from one another by the length of the axle connecting the wheels. This whole unit—the axle with its two wheels—is then put on the lathe, and the two wheels machined simultaneously. With proper connection between the two tools, it is plain that the whole business becomes at once automatic—the wheels must of necessity be turned to the same diameter. The effect is as though there were but one cut being made, instead of two.



The lathe that turns two wheels at once, making them exactly the same diameter

There must be a great variety of uses to which this idea could be put by construction of special lathes. The automatic machine that performs a number of machine operations upon a single piece does not quite fill the bill for the sort of thing we have in mind, which is, as suggested above, clearly a case of consolidating two separate and distinct cuts, between which a certain relation must be preserved, into what amounts to a single cut, so far as controlling is concerned. Wherever any such pair of operations exists, it would seem that the only question which need be asked is whether the product is made in sufficient quantity to pay for such a specially constructed, double-barrelled lathe.

The Cousin of the Cafeteria

A New Type of Self-Service Grocery Developing the Cash-and-Carry Plan

By A. G. Vestal

MANY changes in merchandising methods are resulting from the war-time scarcity of man-power. In past years merchants, competing for trade, have added service after service as an apparent gift to the customer. Credit has been extended, frequent and prompt deliveries made, stamps and coupons and premiums offered, quantity discounts allowed, and what not. These things, however, cost money; what they add to the regular operating expenses could not be charged direct, for the game was to make the customer feel that the items in question were being thrown in. Accordingly it was found necessary to spread the inflated expense out thin over the retail prices of all the commodities sold.

A retrenchment in labor costs is now going on in most retail stores—is being forced on the retailer, in fact. Services once offered, even thrust upon the customer, are now omitted entirely, or left for the customer herself to perform. And, where it is no longer necessary to meet the drain of men and money entailed by the bookkeeping incidental to credit carrying, by the inevitable delayed or denied collections, by the delivery of parcels to points miles from the store, by the giving of presents and discounts, a lower price can be offered as an inducement not previously possible. So today the housewife who wishes a spool of thread delivered to her door—yes, we have seen this done, and in the Christmas season, at that—or a head of lettuce half an hour before dinner when she has already had one delivery from the same grocer earlier in the day, finds her wishes unmet.

The cafeteria, or self-service restaurant, has had a marvelous growth in popularity within the past five years. Thousands of people have shown themselves quite willing to act as their own waiters when the meal is thus served without annoying delay and at a reduced price. The logical development of the cafeteria is the self-service grocery store; and this is already with us, and meeting favor. The most recent working out of the idea has taken the form of an elaborately planned food-merchandising system which has been patented and copyrighted by its inventor. The privilege of using the plan is leased to grocers for a small royalty on their monthly sales, with an initial payment based upon the 1910 census of the territory.

All the plans and specifications, worked out to the minutest detail, are obtained from the home office of the system in Memphis. Everything is covered by the patents and copyright, and the users of the system are required to conform in every smallest item. All the stores, scattered throughout many states, are of the same standard type. As far as such a shop can be seen down the street it is conspicuous by the blue, white and yellow of its front. The interior arrangement, the effective display equipment designed to meet fully the needs of the clerkless customers, the cleanliness and sanitation and decorations, must be alike in all stores using the system. Even the local advertising copy is furnished from the central office.

It goes without saying that the expenses of operation are far below those of the stereotyped food store. The only operatives needed are the few to handle the stock and replenish the shelves and bins, clean the building, check and wrap the purchases, and receive the cash.

How green vegetables and fresh fruit are displayed

The shelves for package goods

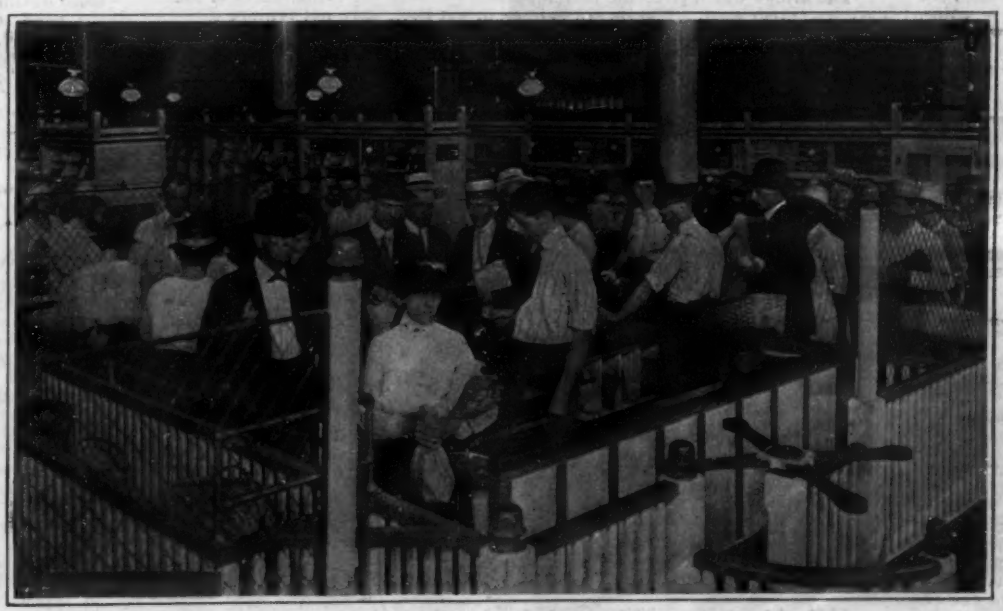
All the patrons enter at the same turnstile and pass rapidly or slowly, as they find convenient, throughout the entire course of the aisles. This is necessary in order to reach the exit turnstile beyond the cashier; in effect, the store is of one dimension. No one is urged to buy any special brand or any special article or anything at all. Upon entering, a market basket is picked up, and the parcels selected during the grand tour are dropped into this. At the desk the bundles are nicely packed into a large paper sack, and the customer receives a check on which each separate item is listed by an adding machine. She pays the cashier as she files past, and the market basket is replaced on its rack near the entrance stile.

A little modification has to be made in the manner of offering goods in order to make possible the universal application of the self-service principle. Almost every article is an original tin or carton. Things which come in bulk, such as dried fruits, beans, rice, oatmeal, cornmeal, are weighed accurately in advance and done up in sacks of one, two or five pounds, with the nature of the contents, the price per pound, and the gross price for the package marked plainly on the outside. For such goods a small glass-faced sample case is attached to the shelf or the bin bearing the packages, so that where there is question of grades or brands the customer may see just what the stuff she is buying looks like. In addition to the prices on the packages, a swinging price tag hangs in front of each article, or, in some cases like that of smoked meats, is actually attached. Double-faced refrigerators for butter and cheese are an integral part of the display shelves, which are arranged in ranks down the center of the store as well as along the sides. In this way a given space is made to give about double the usual service.

No fresh meats are handled. Fresh fruits and vegetables are kept in open wire baskets; and most of these, including bananas, are sold by weight, rather than by count. This of course is an effort to prevent the early comer from getting all the best of the game. But there is bound to be difference in quality as well as in size among the individual pieces in any consignment of fruit; so it would seem that there the old adage would be reversed, and the late bird would get the worm, if worm there was to be got.

A regular part of the store equipment is a battery of electric fans, together with adequate screening. No telephone and no mail orders are accepted; no deliveries are made under any circumstances, even for a fee, and no physical service is given the purchaser in assembling her purchases in the aisles. The extent to which the idea of economy in service is carried may be realized from the fact that no parcels will be held for later call and no checks will be cashed. The whole idea of the system is to give groceries, and nothing else whatever—and to charge accordingly. Everything that could possibly lead to expense or loss has to establish itself as indispensable to the selling of groceries—or out it goes.

Chicago opened five of these shops in June. The earliest of all were in Memphis. Other cities having them are Cincinnati, Indianapolis, Houston, Chattanooga, Nashville, Richmond, Little Rock, Dallas, San Antonio, Austin, Beaumont, El Paso, Port Arthur, Waco, Montgomery, Birmingham, Mobile, Baton Rouge, Shreveport, Louisville, Dayton, Danville, Bloomington and Decatur, Ill., together with a number of less widely known communities. Altogether, 36 cities possess the new model groceries, and announcement is made that within a few weeks 23 others, including Denver and Washington, will have them.



The self-service grocery at a busy hour

Crop Slackerism

A MINNESOTA farmer with a suspiciously Germanic name was haled the other day before the Safety Commission of the State to answer a charge of willful neglect of his 120-acre property. It developed that he had raised no crop to speak of for two years, and had habitually neglected his 10 head of cattle. He pleaded guilty to criminal idleness within the meaning of recent state legislation; a fine of $100 was imposed, together with a pledge that he work his farm honestly. This is the most drastic action of the sort that has come to our attention; and Minnesota's example is commended.

Inventions New and Interesting

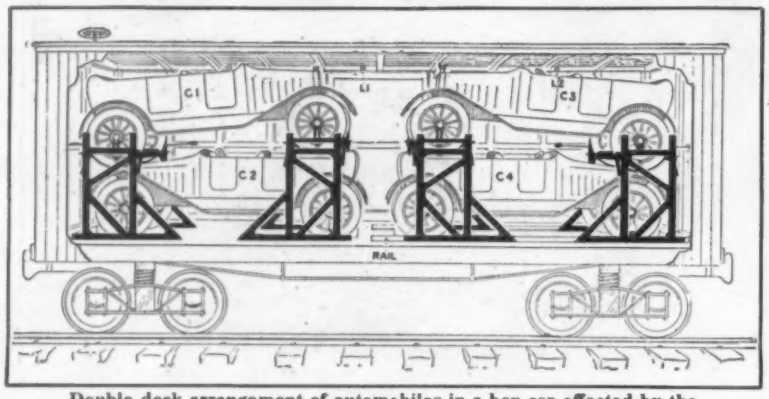
A Department Devoted to Pioneer Work in the Arts

Two-Story Packing of Automobiles

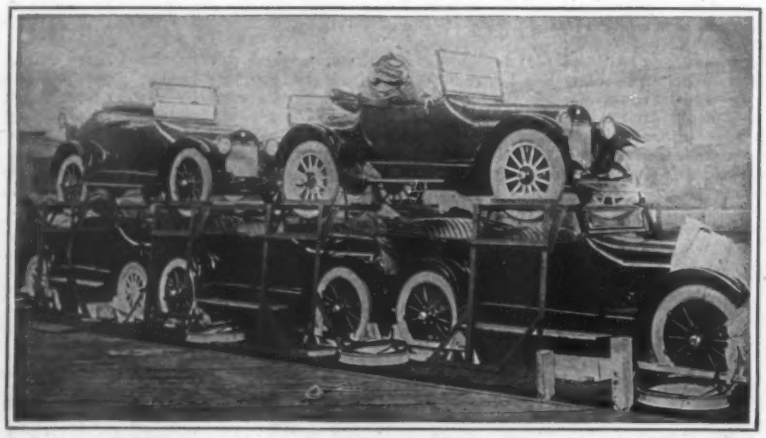
WITH shipping space at a premium many ingenious devices have been brought forward for loading automobiles more compactly and thus shipping more of them in a given space. Few if any of those which we have seen appear to be better worked out than the one we illustrate herewith.

Obviously automobiles cannot be piled indiscriminately on top of one another. Nor can they be packed two deep in the ordinary box car by any ordinary means—for the car is not quite high enough to take the extreme height of two buzz-wagons. But if we can stagger the automobiles by reversing the upper one so that its lower front sits upon the higher rear of the car under it, and if we can give the upper car adequate support in such a position, the thing is done; and our box cars will then be able practically to double their capacity in the shipment of automobiles.

The steel loading deck illustrated herewith works on the principle mentioned. With its use automobiles can be double-decked in any kind of a railroad car. It is claimed that owing to their extreme lightness, the actual cost of using these decks does not exceed that of the wood blocks regularly used for scotching the wheels of automobiles in shipment. The tackle by means of which the upper automobiles are put in place may be left in the car for use in unloading. It is also suggested that the deck is a handy thing to have around the garage as a substitute for the unsatisfactory repair pit. As the manner of its ordinary use suggests, it is adjustable to a high degree, and gives perfect support to an automobile placed upon it.



Double-deck arrangement of automobiles in a box car effected by the aid of loading decks



The steel loading deck for automobiles, which permits of loading twice as many in a box car

A Motor Can Cross, but a Cow Cannot

SHOVED back among the archives of history, in spirit if not in point of time, is the constable who sat with malice in heart and gun in hand, watching at the crossroads for the unwary motorist. In his stead have come signposts and other accommodations conspicuous for their originality and courtesy. The number of towns all over the country is legion which make no more display of their speed regulations than is involved in a sign at the incorporated limits bearing the words, "Blankville; please drive carefully," or "Village of Dashtown; speed limit 20 miles per hour." And these gentle reminders are observed by an ever increasing proportion of the motoring public.

Perhaps the extreme of liberality is that displayed on a stretch of particularly fine road in California sometimes known as the motorist's paradise. Here all bar to speeding is quashed by the flaming announcement "Speed limit 150 miles!" We can imagine the aviator who would be embarrassed by this restriction; but it does not seem to be one which will annoy the man who runs on wheels, for the present at least.

On the cattle ranges of the southwest the motorist has been shown even further consideration. Here there are no public highways; but everywhere there are fenced pastures, so that even the interstate trails cross and recross line after line of fencing. But the nuisance of frequent stops to open and close gates, and the certainty that trouble would be caused by the few disreputable tourists who would not bother to close them, are neatly avoided by borrowing the idea of the cattle guard from the railroad. A shallow pit is dug between two fence posts, and over this at right angles to the road are laid posts or planks close enough to accommodate the wheels of a car but not the feet of wandering steer. There is no gate; the road is always open for the automobilist. But cattle drift up and sniff at this modern contrivance and turn away, too wary of the ditch beneath to venture over.

The bridge which gives the tourist passage through the cattle fences of the great west. Wheels are safe on it, but hoofs dare not venture

A Portable Gasoline Drag Saw

By Frank C. Perkins

THE accompanying illustration shows a unique portable gasoline drag saw at work, as developed at Portland, Ore. It was designed to cut large logs in the forest, the gasoline motor doing away entirely with the large force of men required to cut up the hauls by man-power.

The photograph shows the saw at work on a seven-foot log. It will be noted that the power is transmitted from the gasoline motor to the reciprocating movement operating the saw by a silent chain drive. The gasoline tank is mounted on one end of the portable skid carrying the engine, the tank taking a position above the motor when the saw is at work. One end of the skid rests on the ground, while the other end is held in position upon the log by sharp dogs making a rigid connection and support for the oil engine while in service.

Chain-drive motor saw for rough forest work, sawing on a log measuring seven feet in diameter

New Engine Fuels

WITH the price of gasoline mounting, with more and more farm tractors, motor trucks, automobiles and airplanes for war use to add to the already large number of all but the latter for domestic purposes, with the increasing use of crude oil for many purposes other than distillation, the matter of the gasoline supply of the future looms larger and larger as a coming economic problem of vast importance.

As yet the laboratories of the world have done little or nothing to solve it. The kerosene carburetor is yet a myth, as far as the automobile is concerned, and the various synthetic fuels which are continually gracing the pages of the Sunday newspaper never get any further than the stock promotion stage.

Yet here and there is to be found a hint or a suggestion of what the future may have to do to supply a well-engined world with fuel.

From Denmark comes the news that fishing boats are using fish oil for fuel. Motors at present equipped for kerosene have been successfully operated with fish oil—it is even suggested that cod fishermen might easily make their own fuel from their catch while at sea, which would certainly vastly extend the cruising radius of such vessels.

Knudsen, a builder of Diesel motors in Copenhagen, when these experiments were brought to his attention said: "Fish oil for Diesel motors will be excellent to use as a moving power. No doubt the same oil will also be practical for smaller boats, where the motors do not work according to the Diesel principles but the principles of explosive motors."

The use of gas as a fuel for automobile motors has already been told in these columns, together with the fact that it is highly unsatisfactory, requires either a large storage space, as a gas bag atop the automobile or a compression tank of some size on the running board. But that sugar cane might easily supply a better fuel for motors than coal gas will seem a far cry to those who have not yet heard of the success of Natalite.

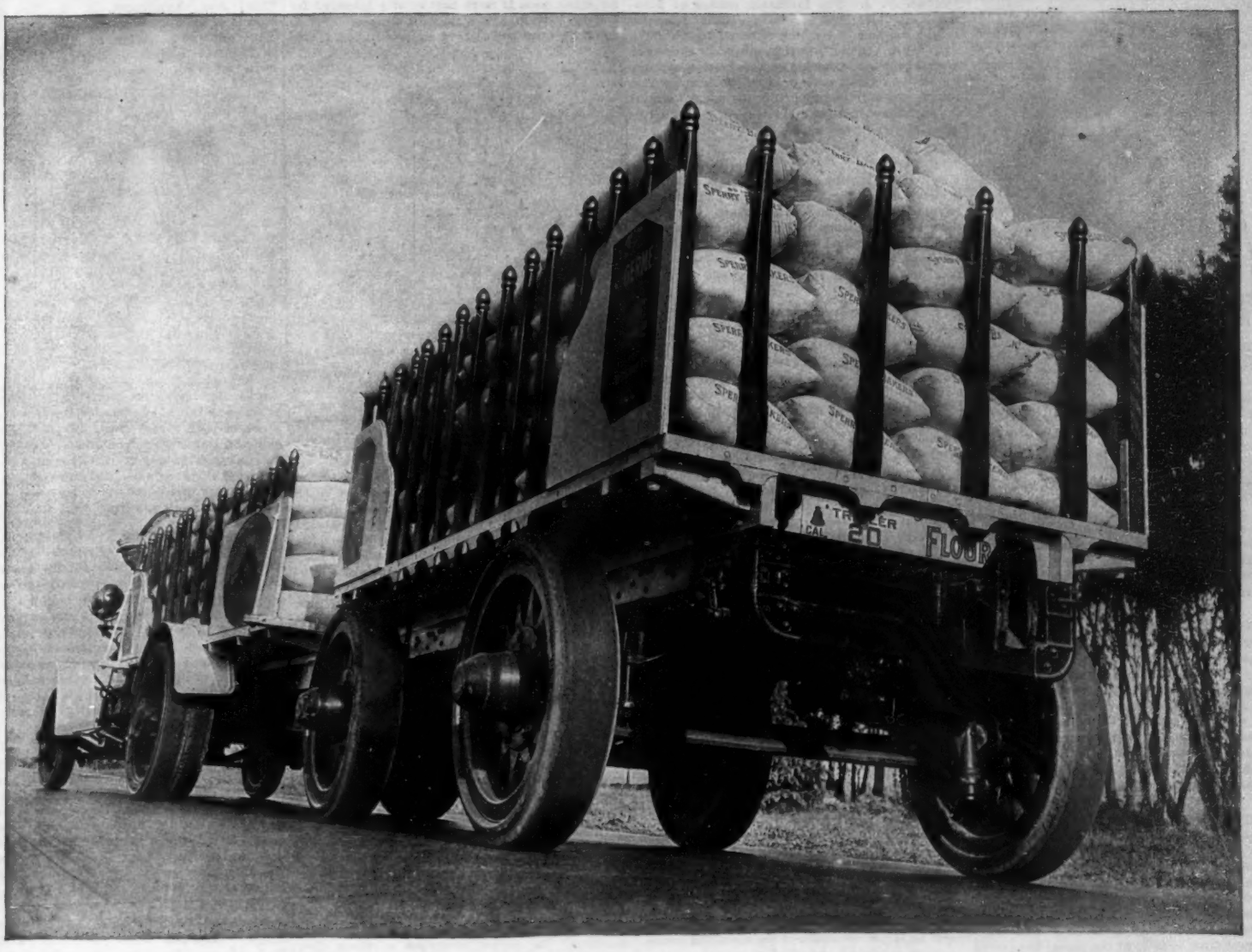
This product gets the name from the country of its discovery. It is no longer a mere laboratory fuel substitute, but is now being made commercially and so cheaply that there appears ground for confidence that in Africa, at least, it may shortly displace gasoline entirely. And if in Africa, why not in any sugar growing section?

The fuel substitute is manufactured from treacle from sugar plantations. In the factory at Merebank, Natal, tanks holding 250,000 gallons are filled with the treacle, from which it is drawn through pipes to mixing tanks and then to 10,000-gallon vats, for fermentation. After fermentation, the wash is distilled. The wash remaining after distillation, called "dunder," is used as a fertilizer, and the product of distillation is further refined by more distillation, separating the best from the good, or the "above 70" from the "below 70," proof. Only "above 70" is used in the preparation of Natalite, while the "good" spirit is used for making the familiar methylated spirit of commerce.

Natalite has been tested in London, and shows better explosive power than gasoline, with the further advantage that its flames are readily put out with water. Further, the corrosive effect of most alcohols on internal combustion engines does not appear with Natalite.

Duo-Negatives in Photography

IN photographing subjects with intense contrasts, the difficulty of securing the requisite amount of detail in the shadows without getting over-density in the high lights is a common experience. The use of films makes it possible to overcome this difficulty by a simple expedient. Two negatives are made, one for high lights with a short exposure, and the other fully timed for the shadows. The parts desired in each negative are then coated with celluloid varnish and the remainder removed with the well-known red prussiate and hypo reducer. When these two negatives are superposed in register, their combined effect is that of a properly timed negative. The method, of course, requires some dexterity in the blocking-out process, and is restricted to films of negligible thickness.



Troy Trailer operated by Sperry Flour Co., California

Getting the Most out of Trucks by using Troy Trailers—

To make any money, Trucks must be **kept moving.**

To make up for all the delays at loading platforms, and later at unloading terminals, a truck must be utilized to the very limit of not only its **load-carrying** capacity, but also its **pulling-power** capacity.

Every good truck has motor power to haul from two to four times what it carries "on its back," so to speak. Just as it is a frightful waste to haul a load of only 2 tons on a 5-ton truck, so it is also a waste to haul only 5 tons on that same 5-ton truck when that truck has motor power sufficient to carry not only its full 5-ton load but also haul **another 5 tons** on a Troy Trailer at the same time.

Troy Trailers

Many concerns have solved their particular hauling problems by using their truck as a tractor only—not carrying a single pound of the load on the truck. Says one such user: "We can't afford to waste the time it would take to load the truck." He has 3 Troy Trailers, one is being loaded at the mine—another with its load is being hauled by the truck to the freight cars—while the third Troy Trailer is at the cars being unloaded.

Troy Trailers are made in from 1 to 5-ton capacity, and with any type of body desired. Can our Engineering Department give you any assistance in helping you figure quicker and cheaper deliveries? If so, write us.

The Troy Wagon Works Co. Troy, Ohio

Oldest and largest makers of Trailers, making possible the highest grade construction at lowest cost

"Liberty" truck drawing two Troy Trailers at Chester Ship-Building Plant.

RECENTLY PATENTED INVENTIONS

Pertaining to Apparel

SHOE DRIER.—E. G. SMITH, Area Officer 44c. Drill Hall, Albury, New South Wales, Australia. The invention relates to drying devices for footwear, the object is to provide an arrangement formed hollow in the shape of a

SECTIONAL VIEW OF DEVICE IN POSITION

shoe, which may be readily inserted into a shoe or boot for drying the same, the construction being such that the inserted member is capable of being heated by hot water or an electrical heating element which will not come directly in contact with the footwear.

NECKWEAR HOLDER.—S. H. SONN, care of Leopold Sonn & Bros., 142 Mulberry St., New York, N. Y. The object of the invention is to provide a holder for four-in-hand and similar neckties arranged to hold the neckwear in position for displaying and examining purposes, to allow convenient removal of any one of the articles by the dealer, and to prevent shifting of the holder, and the articles carried thereby.

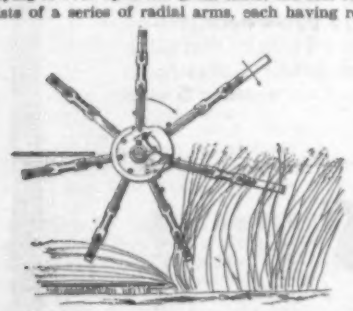
Electrical Devices

TRANSMITTER OR RECEIVER.—K. BOTZ, 10 W. 109th St., New York, N. Y. This invention relates to a device adapted to be used in telephony for converting sound waves into electrical impulses or electrical impulses into sound waves. The device includes a non-metallic diaphragm, a conical helix of conducting and magnetic material having one end fastened to the diaphragm and the other end fixed, means for connecting the ends of the helix in an electric circuit, and means for enveloping the helix in a magnetic field.

ELECTRODYNAMIC MACHINERY.—A. N. SAMMARONE, Akron, Ohio. An object of the invention is to provide an economical means for constructing electro-dynamic machinery such as direct and alternating current generators. A further object is to provide a device in which the parts which are usually made from heavy solid metal, are made almost entirely of pressed and flanged sheet steel, certain of the parts, however, such as the armature core support the boxes, etc., being arranged to hold the heavier metals such as cores and bearing linings.

Of Interest to Farmers

HARVESTER.—J. W. THOMPSON, Spokane, Wash. The invention has for its object to provide an attachment for use in connection with the reel of a harvester for picking up fallen grain and laying it over upon the grain table, the reel consists of a series of radial arms, each having reel



AN END VIEW OF THE REEL WITH THE SUPPORTING SHAFT IN SECTION

slat capable of taking a position in alinement with the arm or at right angles thereto, and extending in opposite directions, and having means for changing the position of the slats to cause them to engage beneath the fallen grain, and to afterward release the said grain.

Of General Interest

AERATOR AND COOLER.—C. L. WILLIAMS, Laurens N. Y. The object of the invention is to provide a sanitary aerator and cooler more especially designed for use by dairymen for aerating and cooling cream and milk; a large cooling surface is provided in a comparatively small space, the device is simple in construction and durable, composed of but few parts, not likely to get out of order, and requires no skilled labor in attention.

COAT HANGER.—H. ROSENTHAL, 802 W. 181st St. New York, N. Y. Among the principal objects of the invention are, to compress the members to form a small package for transportation, and to provide means for hanging a coat and other garments on the same fixture. The coat hanger comprises a plurality of detachably connected arms, a spreader slidably connected with the arms, and means for fixing the service relation of the arms by a plurality of pins.

POWDER CONTAINER.—J. MACDONALD, 240 W. 23d St., New York, N. Y. The invention relates to toilet articles, it is especially designed for containing rouge in powdered form, face powder, and other toilet powders; it is arranged to prevent spilling of the powder on opening of the box, and to permit free and economical use of the powder when dipping it up out of the box with a puff or similar device.

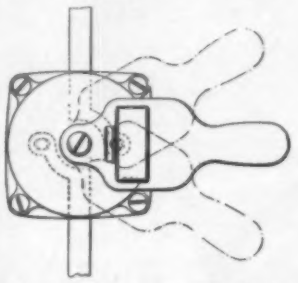
METHOD OF FORMING SOLDERED FUSIBLE LINKS.—L. A. GRIMES, 97 Day St. Orange, N. J. The invention relates to automatic sprinkler devices; it has particular reference to the method of forming soldered fusible links such as are commonly used in automatic sprinklers wherein by the operation of a succession of steps a link is produced so as to be of the most reliable nature not only in supporting the normal strain, but in prompt collapse and release of the sprinkler when an emergency arises.

DESK.—J. SCIANNAMEA, 262 W. 24th St., New York, N. Y. Among the principal objects which the invention has in view are, to furnish a desk with concealed means for automatically locking the same, to provide a master releasing device for permitting the desk to be opened under approved conditions, to disguise the structure of the desk, and provide a piece of furniture which may be separated into independent parts for transportation.

Hardware and Tools

HANDLE FOR JOINTED CONTAINERS.—J. LEVY, care of Savoy Can Co., 541 Broadway, New York, N. Y. The invention relates to containers having a single lock seam, and a handle connected to the container at the seam by infolding a portion of the handle in the seam, the handle being made of sheet metal similar to that of the container. An object of the invention is to provide an inexpensive container suitable for granular material.

LOCKING-BOLT-OPERATING DEVICE.—L. G. KEYES, National Military Home, Kans. This invention relates to locking bolts of that type especially adapted for double doors, double hinged window sashes and the like. A specific object is the provision of a detent or catch



FRONT VIEW OF THE BOLT—OPERATING MEANS

within the operating device, and so related to the handle that the detent becomes automatically released at the beginning of the movement of the handle and automatically set at the end of the movement, it is impossible to move the bolts except by the direct action of the operating means.

COMBINATION TOOL.—J. L. DAHL, Teaneck Rd., Teaneck, N. J. This invention relates to tools such as are used by machinists and wood workers. Among the objects is to provide a tool handle with which a tool bit or blade of a compound nature is rotatably adjustable, but with certain of the parts so constructed as to make accidental or unintentional rotation of the parts impossible, the device is specially designed with the object of strength, simplicity, and safety.

Heating and Lighting

REVOLVING ILLUMINATED SIGN FOR WATER TANKS.—F. W. MEYER, 287½ Third St., Jersey City, N. J. This invention relates to revolving illuminated signs especially adapted for use in connection with water tanks or similar high appurtenances of buildings, whereby valuable advertising space can be utilized to advantage. A specific object is to improve the construction of revolving signs so as to be reliable yet comparatively simple and inexpensive to manufacture and install, and so designed that the letters will be illuminated continuously while the sign revolves. The same inventor also invented the "Marine Fire Indicating and Extinguishing System," which in 1908 was awarded the SCIENTIFIC AMERICAN Gold Medal at the American Museum of Safety Devices, the highest award among all competitors.

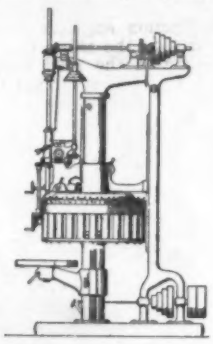
ADJUSTABLE SURFACE GRATE-BAR.—C. CAMPBELL, 350 Park Ave., Rutherford, N. J. An object of the invention is to provide a grate bar structure having a removable surface section provide with with a depending retaining member coacting with a supporting bar, the members being easily detached or removed. The supporting bar is supplied with a plurality of openings spaced at predetermined distances. In order that the supporting bar may not be weakened at the apertures, it is provided with thickened portions at these points.

Machines and Mechanical Devices

TERMINAL CLAMP FOR COIL-WINDING MACHINES.—A. A. WALL, 1510 Gates Ave., Brooklyn, N. Y. The object of the invention is to provide a device to permit the attendant of the machine to quickly, with one single movement, clamp the wires in position without injury and without possibility of any one wire slipping during the operation of forming an armature coil, also to permit an instant release of the wires. By the use of this device the leads of coil are left perfectly straight and even so that the subsequent work of putting on tubing and of turning the leads is made easy.

INTERCONNECTED REVERSING MECHANISM AND CLUTCH.—M. LETROTEUR, Paris, France. The object of this invention is to provide an apparatus for throwing into and out of gear and reversing the direction of motion of machinery which is adapted to be operated by means of a single lever and is applicable with advantage to various machines and devices, for instance to tractors, pressing roller, etc.

MACHINE DRILL.—C. E. COX, 726 9th St., San Pedro, Cal. The invention, although adapted for other uses, is more particularly intended for embodiment in a machine for drilling holes in metal or other substances, or performing opera-



A SIDE ELEVATION OF THE MACHINE

tions such as reaming, tapping, screw threading, winding, milling, or the like. An object is to provide means whereby the tools are automatically attached and detached, and whereby a multiplicity of holes may be bored or like operations performed in succession without stopping the machine.

Medical Devices

CRUTCH.—J. M. PLUMB, Wood Green, London, England. The object of the invention is to provide a crutch which may be very readily converted into a seat in order that the user may rest. The device comprises two pivotally connected parts adapted to be rigidly secured in extended position to constitute a crutch and also adapted to be moved about the pivotal axis and to have attached thereto a strip of webbing to constitute a seat whereof the parts constitute the legs.

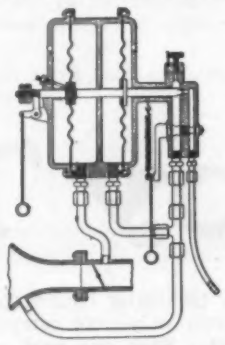
ARTIFICIAL TOOTH.—E. R. HOFF, 275 52d St., Brooklyn, N. Y. The invention relates to dentistry, its object is to provide attaching means for the artificial tooth to the plate and made of gold or other metal cheaper than platinum heretofore used and embedded in the porcelain or other material of which the tooth is made. The artificial tooth is provided with sockets at the back, attaching posts having bases inserted in the sockets, and locking means engaging the bases of the posts to lock them in place in the sockets.

Musical Devices

SPEED REGULATING MEANS.—T. FLETCHER, 404 W. Houston St., San Antonio, Texas. This invention relates to speed regulating means for sound recording and reproducing machines, the device comprises a rotary disk receiving table, a speed controlling wheel in frictional contact with the table, a shaft supporting the speed controlling wheel and having spiral engagement therewith, a governor mechanism, adapted to be operated by the shaft, and means for moving the speed controlling wheel across the table.

Prime Movers and Their Accessories

PRIMING DEVICE.—H. BROOKS, Box 716, El Paso, Texas. The invention relates to means for priming internal combustion engines, and has



A VIEW OF THE DEVICE IN SECTION

reference more particularly to means for continuous priming of the engine until the engine is hot enough or has reached the required speed to operate with the normal supply of fuel. An object is to supply a simple and efficient device which is automatic in its action.

Railways and Their Accessories

RAILWAY SIGNAL MIDWAY WIRE COMPENSATOR.—R. L. POWELL, care of De Penning & De Penning, Calcutta, India. The invention is intended to compensate signal wires which being subject to atmospheric influences alternately expand and contract, when affected by heat or cold during the varying temperatures of the day and night. The device comprises weight cranks to which are attached respectively the wires leading to the signal and signal lever, a member having limited swinging movement and a connection between each crank and one end of the swinging member, whereby all the parts will swing together.

COMBINATION HOSE COUPLING AND AIR VALVE PLUG.—E. W. DE WILTON, 90 West St., New York, N. Y. The general objects of the invention are the provision of an airbrake system for trains whereby a minimum effort is required for coupling and uncoupling, which will allow the couplers to come directly together in a horizontal line and then be uncoupled, and in which the valves in the system are located in the couplers and are turned on and off as the couplers are coupled and uncoupled.

Pertaining to Recreation

GAME APPARATUS.—J. D. NIELSON, 515 Third Ave., Lyndhurst, N. J. The principal objects of the invention are, to provide an amusement apparatus having an educational feature to promote interest in history and geography while affording amusement. The device com-

A PLAN VIEW OF THE GAME BOARD

prises a solid block having formed therein a series of open ended channels, the ends of the channels converging upon a field portion, one of the channels having a curved wall for the delivery of a rolling ball, the delivery end of the wall having a return curve for projecting the ball upon the field portion.

Pertaining to Vehicles

DRIVING AND STEERING GEAR FOR VEHICLES.—T. W. DELANEY, 691 Aurora Ave., St. Paul, Minn. This invention relates to power transmitting devices for power-driven vehicles; it refers more expecially to motor driven trucks having four wheels mounted on non-pivotal supports, and having connections between the motor and all four of the wheels whereby not only will all four of the wheels be driven simultaneously, but in order to steer the vehicle the two wheels on either side may be caused to be driven at a higher speed than the other two.

FASTENING MEANS FOR TIRE GRIPS.—P. SMITH, Foresthill, Calif. The prime object of the invention is to provide a fastening means for fastening grips to automobile tires, adapted to be disposed transversely beneath the wheel felly and arranged to be fastened or unfastened with facility and dispatch to secure the grip in position or permit its ready removal. The grips for which the fastening means is more particularly intended are separately applied to the tire in any desired number.

DEMOUNTABLE AND INTERCHANGEABLE WHEEL FOR MOTORCYCLES.—D. L. HICKS, Cherry St., Hicksville, L. I., N. Y. The object of the invention is to provide an interchangeable wheel for motorcycles, arranged to permit of a quick removal of the rear traction wheel for repairs or other purposes without disturbing the driving means on the brake mechanism. Another object is to permit of interchanging the rear tractor wheel for the front or steering wheel whenever it is desired. To accomplish the result, use is made of means for detachably connecting one end of the hub of the rear wheel with the driving gear, and detachably connecting the other end of said wheel hub with the brake drum.

PROTECTIVE ARMOR BELT FOR PNEUMATIC TIRES.—J. CLYDESDALE, 13 Dartmouth St., Hempstead, L. I., N. Y. Among the principal objects of the invention are, to prevent the puncturing of an inner tube of an automobile tire, to strengthen the resistance of a tire to the air pressure, and to provide an armor comprising a plurality of interlocking plates, sufficiently flexible to assume the shape of the tread portion of the tire.

FOLDING BACK.—H. W. WEED, care of Y. M. C. A., 22d St and Prospect Ave., Cleveland, Ohio. The object of the invention is to provide a folding back for motor cycles, bicycles, and like machines and devices, arranged to permit the rider to readily swing the folding back into an approximately horizontal position for mounting and dismounting purposes and to swing the back into upright position for supporting the back of the rider.

WHEELED GUN CARRIAGE WITH WIDE SCOPE OF FIRE.—E. RIMEILHO, Paris, France. This invention relates to gun carriages which at the moment of firing are in contact with the ground at four points, the points being represented by the lower part of each wheel and by the ends of the two trails. The object of the invention is to provide a gun carriage in which this purpose is secured, by connecting the "axle-wheel" system to the "trail" system through the agency of a ball and socket joint, the male part of which is carried by one of the two systems and the female part by the other.

Designs

DESIGN FOR A BADGE.—J. H. LEFF and R. H. SPIRA, care of Isidor Cohn, 299 Broadway, New York, N. Y. This ornamental design represents a triangle in red, white and blue, on two sides of which are the words *world's war*, and in the center of which is shown the shield of the stars and stripes.

DESIGN FOR A TIRE.—F. M. HALE and F. C. MCLAUGHLIN, Kent, Ohio. The design shows a tire formed with a center rib and ratchet-like notches on either side.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

The Current Supplement

THE expenditure of munitions in the war runs up into fabulous figures that are difficult for most of us to realize. In small arms ammunition the daily demand runs up into the millions, while for the larger guns the consumption may run into hundreds of thousands. To produce the immense quantities required, the failure of which, even for a single day, might easily bring disaster, necessitates a wonderful and far reaching system in manufacture. *Co-Ordination in Munitions Work*, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2227, for September 7th, is a study of what has been done in England and the methods followed. *Military Searchlights* tells something of the way this valuable apparatus is used in warfare, and there are several photographs showing American equipment. *Plant or Animal?* gives a short account of singular organisms, the Slime Fungi, and is illustrated by two photographs. There is a second instalment of the important paper on *Modern Aeronautics*. *Mechanotherapy* gives some insight into methods devised in France for rehabilitating soldiers who, from the result of injuries in the war, have lost the use of certain muscles. A number of particularly interesting photographs show some of the simple, but ingenious methods and apparatus employed. *The "Grain" of Wood* defines the meaning of a term frequently heard, but not always understood, and also describes different ways in which the term is used, a number of explanatory diagrams being shown. *The Insects of the Primary Era* is a study of certain fossil remains in the upper coal strata of Commentry, in France. Other articles of interest in this issue include *Pitch as Fuel*, *The Gelation of the Natural Emulsoids*, *The Importance of the Non-Metallic Inclusions in Steel*, *Electricity Recovery from Electric Traction* and *Cotton Seed Products and the Chemical Industries*.

The Government's Vast Building Program

(*Concluded from page 187*)

started, was changed and construction delayed, while additional pilling could be done at the new site. An additional pier was added to the project.

"Taking one of the Ordnance depots as a sample, the plans for the general development were fairly well settled and construction work was laid out and started on the basis of building about eight magazines to start with, with plans for increasing this number as necessity demanded. After the construction work was started, it was decided by the Ordnance Department to add several hundred thousand square feet of building space for use in connection with the Carriage Department, which had formerly had no connection with the job at all. This necessitated considerable changes in the railroad arrangements. After the work had gotten well under way again it was suddenly found necessary to add a cantonment to house 5,000 troops which had not previously been considered as even a remote possibility in this connection. It was also necessary to get the housing for these troops in the shortest possible time which necessitated radical changes in the construction organization, sacrificing the organization on the original contract to make possible the necessary speed under the new conditions.

"In the case of a shell filling plant for the Ordnance Department, that Department had started out on small construction project for a plant for filling shells with poisonous gas. It was apparently not originally contemplated that this would be a plant for any other process than filling the shells themselves with this gas. The Ordnance Department had started the construction of this plant previous to the time when the Cantonment Division was directed to undertake all construction work. The contracts used by the Ordnance Department were something special and are now the subject of considerable negotiations as to their actual meaning. In the meantime it has been decided to add to this plant which was originally thought to involve and expenditure of a few hundred thousand dollars, a chlorine plant, a large power plant and other parts necessary for the complete manufacture of poisonous gases as well as loading them into shells, so that the total expenditure as now contemplated is stated to be over $30,000,000.

"The above samples may be taken as representing the conditions on most of the work which the Cantonment Division is doing. There have not been many jobs where the changes or difficulties as affecting contractural relations have been materially less than those above enumerated."

When a Hundred Million People Go to War

Another article on the Government's contract will take up in detail the report of that Board, but the quotation above is interesting as indicating what happens when 100,000,000 people all go to war together and start trying to do a whole lot of things all at once with a lot of new organizations composed perhaps of experts who no doubt know what they want but who overlook the fact that wanting a certain facility is a far different thing from getting it. To plan it all out scientifically and with skill and patience as only the expert construction engineer or architect can plan—that is the thing that perhaps was overlooked in the mad rush by the bureaus to get buildings. That the whole construction program did not collapse under the violent eruptions described by the Construction Division is a tribute to that organization and the wise policy under which it worked.

As the war goes on building matters are becoming more stabilized, everybody is coming better to understand the problems involved and the indecisions and reversals of decision on the part of bureaus, indicated in the report from the Construction Division, are becoming fewer. However, it is a far cry from that condition to the happy day when a bureau can lay down a set of specifications and say "These things we want—no more, no less. As they are described they completely fill our wants." When that day comes the Construction Division will be able to say with equal celerity: "In blank days we will have for you completed drawings and specifications. Upon your approval of them we will put an organization into the field and construct your work in so many days at a cost of so many dollars." We will then be confronted with a wholly different situation from that which now exists.

Unexpected Daily Changes

In the meantime the question is being continually asked "What is the Government going to build, where will it build it and how much will it spend? In fact what is the Government's building program?" These are the hardest of all questions because nobody knows. The exigencies of the war itself preclude any comprehensive statement. The changes from day to day are so violent, new and uncontemplated demands arise so unexpectedly due to new developments of the war game that anything definite is out of the question. For example, some new gas is invented and immediately there is a demand for a factory in which to make it. Almost over night the whole thing happens and the Construction Division has a force in the field hard at work building it before we realize it. Again, a carefully considered project hangs fire sometimes for months and is even finally abandoned. Between those two extremes there is every conceivable variation. One fact, however, is bound to impress itself upon anyone who has the opportunity to study the problem and that is, that vast as the Government's building program is, there are almost twice as many projects proposed as are ever built. Nearly every post commander, plant superintendent or other Government official having space requirements has some scheme for building. These in due course are presented to the War Department for approval and they are very carefully scrutinized. Many are rejected and many are modified. The vigilance of the War Department authorities in this respect is truly remarkable considering the pressure of their work, nevertheless the actual building requirements have been stupendous and are likely to continue to be so.

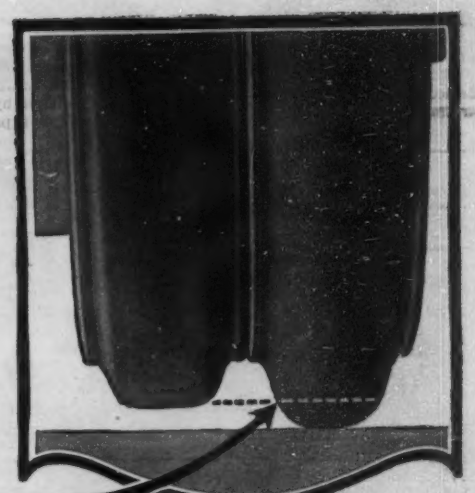
In his statement in the *Official Bulletin*, dated June 19th, 1918, Secretary Baker said:

"Emergency work to house and provide for the wants of soldiers in this country and to provide buildings for the manufacture and storage of supplies for the Army, both here and abroad, undertaken by the construction division of the Army, which has been executed, or is under way and in prospect to June 1st, will, it is estimated, cost $1,170,619,040. This total does not include three operations costing $106,000,000, which are being conducted under the direct control of the Ordnance Department.

"All work done under the direction of the construction division is performed under an emergency contract, which is based on the cost of the work plus a percentage with an established maximum fee. By this contract no contractor can receive a fee of more than a quarter of a million dollars, no matter how great the total cost of the operation may be.

"Up to June 1st the Division had completed 53 jobs at a total cost of $202,250,000. It now has 244 operations under way, which when finished will cost approximately $270,369,040. Preparations are being made to start work on 117 new operations which are expected to cost $700,000,000.

"Of the finished jobs, 36 were at cantonments and camps. The total cost for National Army cantonments was $140,726,473. General contractors' fees were $4,000,000, or 2.84 per cent of the total. From this amount the contractors had to meet all their overhead expenses of organization. The National Guard camps cost $38,375,272, on which the Government paid fees amounting to $2,636,534, or 6.98 per cent of the total. In every case the contractors were compelled to meet the expenses of maintaining their organiza-



1/3 MORE RUBBER ON THE TREAD

GOODRICH science introduced it—the Goodrich De Luxe truck tire—with *a third more rubber on the tread* than appears on ordinary tires of equal width.

If ever there was need for such a tire it is *now*. The ranks of mechanics are thinning. This means that your truck, once injured or crippled by a broken part, remains longer in the repair shop. And when it comes out, possibly a week later—my, what a bill!

Safeguard those working parts with this *third more rubber on the tread!* It gives you greater cushion. It smothers vibration. And it certainly gives you greater mileage. Not to mention economy in operation.

THE B.F.GOODRICH RUBBER COMPANY
The City of Goodrich—
AKRON, OHIO
Branches and Distributors Everywhere

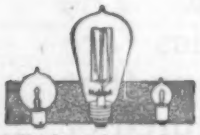
GOODRICH
De Luxe
TRUCK TIRES

MAZDA

"Not the name of a thing, but the mark of a service"

MAZDA is the trademark of a world-wide service to certain lamp manufacturers. Its purpose is to collect and select scientific and practical information concerning progress and developments in the art of incandescent lamp manufacturing and to distribute this information to the companies entitled to receive this service.

MAZDA Service is centered in the Research Laboratories of the General Electric Company at Schenectady, New York. The mark MAZDA can appear only on lamps which meet the standards of MAZDA service It is thus an assurance of quality. This trademark is the property of the General Electric Company. 4648



A MAZDA Lamp for every purpose

RESEARCH LABORATORIES OF GENERAL ELECTRIC COMPANY

Low Cost of Upkeep

ROTH MOTORS

Successful More Than 20 Years

are built for work, not for idleness in the repair shop. So they give steady, day-after-day service at a low cost of operation. Twenty years' success is their best recommendation. Write for full facts.

Roth Bros. & Co.
198 Loomis Street
Chicago, Ill.

ECONOMY renewable FUSES

Replace the Link—Renew the Fuse

cut annual fuse maintenance costs 80%. Can be used over and over. An inexpensive "Drop Out" Renewal Link restores a blown Economy Fuse to its original efficiency.

ECONOMY FUSE & MFG. CO.
Kinzie & Orleans Sts., CHICAGO, U.S.A.
Sole Manufacturers of "ARKLESS" the Non-Renewable Fuse with the 100% Guaranteed Indicator.
Also made in Canada at Montreal

ELIMINATE NECESSITY OF GASLESS DAYS

WITH PROPER CONSERVATION NOW

Conserve fuel—
Insure adequate supply for any war-time emergency—liberate every possible penny for *patriotic* investment.
The New Stromberg will back up to the limit *your* efforts to serve the Nation through strictest of fuel economy.
Write for literature. State name, model and year of your car.
Stromberg Motor Devices Co.
Dept. 916, 64 E. 25th St.
CHICAGO, ILL.

New STROMBERG Does it!
CARBURETOR

tion from the fees collected from the Government."

Here we get a line on the magnitude of the thing. In peace time our greatest building concerns are busy when they have from twenty to thirty millions dollars worth of work on thier hands. A great corporation will sometimes build fifteen to twenty million dollars worth of structures in a year. To do this it has a well established administrative organization built up through the years of its growth. Somewhat different from the Government's problem where we are spending over a billion dollars a year with an administrative organization that is hardly a year old. And the end is not yet. Since the issuance of Secretary Baker's statement, above given, which indicated about $1,300,000,000 worth of work, requests for about $500,000,000 worth of additional work have been made and this does not include the construction abroad nor does it fully provide for the further enlargements that will undoubtedly become necessary with the increase of the army due to the proposed extensions of the age limit. Perhaps a round figure for the present and prospective building needs of the Army in this country would be two billion dollars. To the above the overseas demands must be added but, granting that they are not so great, we are still dealing with a program of such stupendous proportions that we need have no fear concerning our laurels as the world's greatest nation of builders.

Is the Motor Car a Non-Essential?

(*Concluded from page 188*)

are, indeed, wickedly at waste when we should be at work. But will some one who knows kindly advise how we could reinvest this capital and reëmploy this skilled labor to better advantage in something else than making cars?

Again the answer comes, "Why, making munitions, of course." But the reply to this is two fold. First, "We don't need and cannot use so many" and second, "Not all auto plants and certainly by no means all auto workers, are transmutable into munitions plants and workers in a time sufficiently short to make their services of value equal to the economic loss of the time that would be spent in change and instruction."

A Self-Delivered Product

There are only so many tons of shipping available to ship men and munitions abroad. True, we are increasing that tonnage by leaps and bounds, but so far we have been able to fill every ship to the guards. We are not suffering from a lack of production, but a lack of transportation. The Government is doing a wonderful job with its railroads, but even it has had to limit the making of new manufacturing plants in certain areas, because the railroads simply cannot transport the war material already manufactured, let alone take care of the product of new plants.

The product of the automobile factory need not—and in many if not most cases now does not—make any demand upon the railroad to deliver it. It delivers itself on its own wheels under its own power.

Out of a partisan clamor from a thousand throats that this, that and the other thing "will win the war" it is difficult to choose the right answer. But whoever is right, it is obvious that the war can't be conducted, let alone run, without money and plenty of it. That money can come only through taxes and through mortgaging the future (bonds). But where is the money to pay the taxes and buy the bonds to come from?

Money, in the last analysis, is nothing but an easily transferable form of labor. Indeed, the great bulk of our business is accomplished without any physical money at all—merely by the transfer of credit, the use of paper and promises to pay. But hard experience has shown that there must be a moneyed foundation behind credit, and that the promise which cannot be redeemed, *if necessary*, is valueless as a commercial medium. The paper money of the Confederacy, or, more recently, of Mexico, illustrates the point—"fiat" money won't purchase!

Now 2,000,000 wage earners, supporting from seven to ten million people, cannot be summarily thrown out of jobs without a volcanic upheaval of credit. To say "make them make munitions" is easy enough, but practically, the change—were it contemplated—would take years, and during those years, especially during the present, immediate *now*, the Government needs the wage earner to earn, that there may be money to pay, for the war which is being fought now—not a decade hence when the change from automobiles to cannon and shells might be completely accomplished. To put the automobile industry out of business because it makes what is falsely called a "luxury" would be to invite disaster if only because of the disruption of the earning power and thus the responsiveness to the taxing power.

Consider for a moment what the automobile industry does with money; it uses about $250 000,000 worth of iron and steel; $150,000,000 of lumber; $20,000,000 of brass; $32,000,000 of copper; $25,000,000 of cotton fabrics; $20,000,000 of coal and coke; $26,000,000 of tin; $16,000,000 of lead; $42,000,000 of electrical equipment, and $24,000,000 hides and hair, to mention the value of only a few items. There are over 300,000 trucks and 4,000,000 passenger cars in operation in this country. The advertising bill runs well over $23,000,000 annually, to say nothing of the money spent for advertising tractors and other gas-engined machines, which may be properly classified as belonging to the industry.

Suddenly kill an industry of that magnitude and it takes no vivid imagination to see what the result would be to our commercial fabric.

But now let us look at the other side of the shield—the automobile as a necessary aid to transportation, not as an industry. Leaving out of all consideration the motor truck, which even the "luxury fighters" from the backwoods recognize are as essential as railroad trains—consider the 4,000,000 "pleasure" cars of this country

Wrong Interpretation of the Word "Pleasure"

In the first place, they are not, of course, "pleasure" cars at all. Originally any motor made to ride in, as distinguished from one made to haul goods in, *was* a pleasure car. So was the first railroad car, the first Pullman, the first trolley. Does any one buy a berth in a "pleasure Pullman" today? Or ride to work in a "pleasure trolley"? Do we have "pleasure telephones" and "pleasure electric lights"? Undoubtedly the vast majority of the 4,000,000 passenger automobiles are used part of the time for pleasure, but the rest of the time they are as truly business adjuncts as the truck. Is the doctor's runabout a "pleasure car" because he takes his wife joy riding in his leisure hours? Is the car the business man uses to go from city's end to city's end in the pursuit of the elusive dollar a "pleasure car" because it also takes him to the theater?

It is not an argument to say, "Well, let those that have 'em, run 'em, but don't make any more," because when anything has become woven into the economic fabric of a people, it must be supplied, renewed, kept going, or the fabric itself suffers materially with the disintegration of its part.

Those 4,000,000 cars have grown into our lives. We have made them important factors in our entire program, business, pleasure, health, vacation, labor. The cars wear out, they need repair, they need replacement. If we cannot repair and replace, we must remake our lives accordingly, and while, as England has demonstrated, it *can* be done, it is a fearful wrench. And if it was a wrench for the "tight little isle" what a cataclysmic disturbance it would be in this huge country!

This is no argument that we don't stand ready to do it, if the need can be shown. But it is a very potent argument against creating the need by ill-advised talk, by hasty legislation or snap judgment in high places. If we can't make enough war material without calling on every automobile factory and every automobile workman to help, then by all means kill the motor industry. But if—and the facts show that we can—we *can* make *more* than enough *without* doing more than curtailing the industry which is third largest in the United States according to old figures, and which would certainly be second if not first in size by now were it not for the war—then to dodge the facts and eliminate from our commercial, economic and business life so vital a factor as the passenger car, would be to invite a widespread economic calamity not the less great that our comforters would point to England and France and say, "They did it first!"

Teaching the Worker to Feel the War

(*Concluded from page 191*)

This attitude of confidence and affection on the part of the masses of our citizenship towards these three leaders in our ship program is in itself a striking comment upon the dignity and value of democracy.

When one undertakes to visualize the vastness of this enterprise the imagination falters. We have undertaken to expend $3,800,000,000 in the production of ships. This is as much money as the Government of the United States ever expended in the three most expensive years of its history.

This vast program is being carried forward in nearly 150 shipyards dotted around the entire coast-line of the United States. Scores of these shipyards a year ago did not exist. The three great fabricating plants, the Submarine Boat Corporation, the Bristol Yard, and the Hog Island Yard have all come into existence within the past 12 months. Not only have these vast plants been built, but they have already begun to produce ships. A few months more and these three yards alone will eclipse in their output the entire energies of the nation before the war. In the great Fore River

Plant at Quincy, Mass., a naval construction program of unparalleled magnitude is going forward. Mr. Wakeman, the General Manager of this vast enterprise seldom sees his name heraled abroad, but he stands there amidst the mighty enginery of the shipyard, a great leader of the hosts of freedom. No general, no admiral can possibly outrank such men in their contribution to the winning of the war.

At Squantun, a few miles away, despite the unspeakable weather conditions of the winter, there grew out of the frozen muck the great Victory Plant which has already, within a few months of its beginning, produced ships of the highest grade.

We could mention a number of others of equal worth and magnitude on the Atlantic seaboard if space permitted.

In the Great Lakes district, which is an old shipbuilding center, the tide of efficiency and service keeps pace with the general movement throughout the nation. On the Fourth of July, at the Ecorse Plant of the Great Lakes Engineering Company, a ship was launched which had been built in 14 days.

On the Pacific coast, the great Todd Ship Yard at Tacoma has grown in 12 months out of the sea. Where these towering buildings and great hulks now stand, with thousands of busy workmen swarming to and fro, 12 months ago the blue waters of Puget Sound rippled with the eddying tides.

A year ago there doubtless were men who wanted to build ships for the purpose of making money. Today the ship contractors stand forth, publicly and privately dedicated to the winning of this war, regardless of their gain or loss. I have heard more than one great ship-master place his entire facilities at the disposal of the Government, simply as a patriotic service, without regard as to whether there were a dollar of profit or not.

The National Service Section receives almost daily inquiries as to the method and results of its work. We are organized as a branch of the Emergency Fleet Corporation, and as such we represent the United States Government. We exist for the purpose of helping to win the war by a campaign of education and inspiration not only among the men who build ships or who supply the accessories for ships, but also among the masses of the people. Our religion is to beat the Kaiser. This is our politics. We know neither party nor sect. We have nothing to do with class distinctions or class consciousness. We speak to men simply as American citizens whose country is in danger and who are therefore under obligation to either work or fight to save it.

Slowly but surely the workingmen are passing out of the era of class consciousness. The larger ideas of nationhood and community interest are finding a welcome in their minds. Here and there are leaders who have not yet caught the new spirit, but, as a rule, the labor leaders are showing themselves patriotic to a high degree and are leading their men by example of precept to serve the nation. We have been the means of averting a large number of threatened strikes and other troubles. Almost invariably when these difficulties arise we present to the men and management the situation as we see it from a national point of view, and almost without exception the men agree to postpone consideration of their grievances until they can be adjudicated upon by the War Labor Board, which is an official instrument of the Government for such purposes; and, furthermore, they agree to abide by this decision. In many cases great throngs of workingmen voluntarily pledge themselves not to strike, no matter what grievances may arise, until the war is won.

We have not reached a condition which even approaches perfection, but we are infinitely better off than we were a year ago. All classes, including the workingmen, are beginning to think in terms of the nation rather than of the class. This alone is an achievement which amounts almost to a revolution.

Because of the high wages and other conditions which need not be mentioned here, there has been an immense turn-over of labor not only in the shipyards but in industrial plants auxiliary to shipbuilding. In some sections this turn-over has reached the unbelievable total of 500 per cent. We have seen this condition gradually improve. As the men become aroused morally to their responsibilities, they are settling down to their task and staying in one place. The great thing that is needed now is a national wage-scale which will remove from the restless, floating portion of labor its incentive to move. We are nearer achieving this today than we were even a few weeks ago.

It has been my personal belief and hope from the beginning of the war that labor and capital both in this country would so organize themselves that they could place their entire resources at the disposal of our Government, not in sections, in groups, or in classes, but nationally. I believe the facts warrant the statement that we are fast approaching such a consummation. The Labor Department, with its new program for labor enlistment and appointment, has made a tremendous step in this direction. Wage equalization and adjustment must keep pace. Governmental control of housing and transportation will help. Continuous education in the principles of citizenship is absolutely essential not only in shipbuilding but in every department of our life.

I cannot close this fragmentary statement without sounding a note of warning. We are going to win this war; but after we have won the war and peace comes, our nation, and all the nations, will face conditions of appalling difficulty and complexity. The soldier and the sailor will have to be provided for, in accordance with their just claims upon the gratitude of the nation. The share of labor in the national wealth will have to be settled on permanent and just principles. Labor in its organized form here, as in England, will have to develop a program worthy of the new age. It will no longer be a matter of hours and conditions of labor, and rates of pay. The problem will gather around this question: Can we find a way by which labor will cease the hireling relationship and become consciously a partner and participator in the common wealth!

What is true of labor will be equally true of capital. The age of capitalistic lawlessness is gone forever. But in the new age capital must have just as square a deal as labor. No democracy can ever abide which turns from its strong men and looks for leadership to the weakling, the ignorant, and the inefficient. Bolshevikism is as bad as Prussianism. America will have nothing to do with either, except to fight them to a finish.

Our whole social structure will have to be rebuilt. Religion itself must find a new medium of expression. Politics must in some way seek and find rehabilitation and regeneration. Our whole educational system will have to be rebuilt to meet the new needs.

It will be a time to try men's souls, but, because of the magnificient girding of our nation for the winning of the war, we may look forward hopefully, and believe with an unwavering faith that the common sense, love of liberty, and innate honor and justice of the American people will, under the good guidance of God, find an answer to all questions affecting our life and that our people will go forward through the difficult years to the establishment of a new age in which brotherhood, opportunity and, above all, the spiritual, shall find full and real recognition.

"The Wasters"—and Fair Play

(Concluded from page 192)

of other services, a new industry of a most highly skilled character necessarily puts a heavy strain upon the organizing and manufacturing ability of the country."

Where the aircraft program in this country has undoubtedly failed is in the flambouyant, even outrageous publicity it received—let us even admit that it sought—in its early days, and in too much optimism. The public was misled, deceived, bamboozeled if you will. But—let the reader who knows Americans and American ways and American methods, answer. Had it not been for the publicity and the catching on of the idea of a huge fleet of planes, in our all-too-vivid imaginations, would we ever have had a $640,000,000 appropriation in the first place?

Destroying Initiative

As to optimisim, of course it and it alone was at the root of mistaken prophecy. But as one Army officer concerned said: "Thank God we had optimism enough to go ahead and make mistakes. It's only by making mistakes you can learn. We were brave then—all we saw was a need, and a way to fill it. We are timid now—we are afraid of doing this or that or the other because 'how will it look before an investigating committee?' is always in front of us. It may be that other men working in other ways, could have produced more planes in the same time, but I believe that a few Senators and Sculptors and things like that have done more harm to the program by slowing up our initiative and making us executives without optimism, than all the errors of commission and omission of which the service as a whole was guilty!"

All of which is strong meat, perhaps, but may have a real bearing on the question at issue.

It is not a question, this matter of time consumed and results attained, which is specifically and entirely American. England had the same ideas that we had—"do it in a month"—England found out differently, just as we have found out differently. Her report states that:

"The science of aeronautics is in a state of constant development; improvements in engines, aeroplanes and their numerous accessories are being constantly worked out. But the interval between the discovery of an improvement and its introduction into the service is, owing to technical considerations, very much longer than is commonly supposed. Experience shows that, as a rule, from the date of the conception and design of an aero-engine to the delivery of the first engine in series

Get your slice of thorobred-smoke-sport!

Pull the monkey wrench out of your smoke-gears with a tidy red tin of Prince Albert—*and*—get-down-pat the hang and the happiness of making every puff of a jimmy pipe or home rolled cigarette bring you smokejoy, Sundays and holidays included!

PRINCE ALBERT

the national joy smoke

will give you a heftier satisfaction-handout than your keenest hankering ever demanded; yes sir, it will biff-in that *quality* flavor and fragrance as fast as you can fire up, *without a chance* of tiring-your-taste or fussing-your-tongue! *Quality tobacco*, and our exclusive patented process (which cuts out bite and parch), certainly does take care of all that!

Elect yourself into the Prince Albert-eers—the biggest smoke-fraternity on earth—*then*, you'll be fit-as-a-fiddle to hand out smokesmiles whether the sun's up or down!

For, with P. A. for steady company you're equipped to get so much fun out of every pipe load or makin's cigarette you'll wish these early fall days were two hours longer instead of one! You *just hate yourself for having to lay-to while you're asleep!*

Buy Prince Albert tobacco in toppy red bags, tidy red tins; handsome half pound and pound tin humidors—and—that clever, practical pound crystal glass humidor with sponge-moistener top that keeps the tobacco in such perfect condition.

R. J. REYNOLDS TOBACCO CO., Winston-Salem, N. C.

3 features you will find in the METROPOLITAN *every month* and in no other magazine—

Theodore Roosevelt

COLONEL ROOSEVELT'S PAGE

The issues of the day interpreted and flavored with the robust Americanism of "an American's American."

H. J. Whigham

THE WORLD TIDE

The world and the great forces directing the destinies of nations seen through the eyes of one who knows the Bagdad Railroad as you know your home street.

Clarence Day, Jr.

THE BUSINESS OF LIVING

The whimsical, sane and heartening philosophy and observations of one who loves books and life. The freshest feature you will find in any magazine.

The above plus special articles and real-life fiction go to make the METROPOLITAN incomparably the best magazine in America.

This coupon will bring the METROPOLITAN to your home every month. Send no money now. Wait for our bill. Enroll now and make sure of your copy. The editions of the METROPOLITAN are limited because of paper conservation.

S. A.

METROPOLITAN, 432 Fourth Ave., N. Y.

Send me the METROPOLITAN, each month, for one year. I will remit $2.00 on receipt of your bill and first copy of my subscription.

Name .....

Address .....

.....

Canadian postage 50c; foreign postage, 85c.

by the manufacturer more than a year elapses; the corresponding period for an airplane is about half as long. Consequently, plans have to be laid for a long period ahead, and these plans are liable to be upset by many uncertain factors. The hopes based upon the promising results given by the first experimental engines of a new design are frequently disappointed owing to difficulties of bulk manufacture or to defects only developed after long trial in the air; new types of airplanes favorably reported on when first tried are found on longer experience not to give complete satisfaction, and yet it is impossible, if we are to keep ahead in the keen struggle for aerial superiority, to wait for full experience before placing orders. Risks must be run, and new types must be adopted at the earliest moment consistent with reasonable assurance that they will constitute a substantial improvement on what is already in use. Orders must be placed, moreover, for considerable numbers and for delivery over many months, as the large output required for our present flying services can only be obtained by bulk orders permitting a high degree of subdivision of work."

Depending on the Automobile Industry

We are accused of leaning too heavily upon the automobile industry. Our automobile men, in Senatorial opinion, have too much to say about our program. But, if it were not for the automobile men and the automobile factories, where would we have turned for any results at all? Where would England, France, Italy, Germany herself have been, without her automobile industry to make aircraft engines? Rolls-Royce, Isotta, Fiat, Renault, Mercedes, Benz—they are the famous foreign automobile engine makers and they are the makers of the famous foreign aircraft engines. The automobile industry was the only industry with the plants, the organization and the force of trained men capable of doing the work. The men who designed the Liberty motor and put it in production were the flower of the engineering and production skill of the whole world. If they couldn't do it, it couldn't be done. Moreover, even if it were possible to have created an engine industry out of nothing—as the plane-making industry was created—how would it have upset all the other production agencies of the country had we had to stop other work to make machinery, to build factories, produce an organization? No other industry capable of doing it but the automobile industry existed. Exclude them, and build up a new engine industry and we would have paralyzed war work of a much higher degree of importance, perhaps, even, than aircraft.

As to whether we would have gone further and accomplished more had we had in the beginning a Department of Aeronautics, is a question which can never be settled. Some think we would, others insist we would not. But there is a general feeling in official circles in the capital that the principal mistake which has been made was one of time—not of plan or purpose or method or even of result. Undoubtedly we supposed, our official led us to suppose, even our Secretary of War was misled into supposing, that we would have a great many more planes in service in a short interval than was possible. It was a mistake. But that we would actually have had any more under a different organization is doubtful. The results of today, the actual industry which has been created, the motors, planes, parts, schools, men, guns, supplies, raw materials, which are now coming through and which have so far supplied our allies with what, had they not had it, would have crippled them in the air, stand for themselves and no report on inefficiency, mistakes, waste or error can alter the fact.

A year ago we had nothing.

Today we are organized, are producing, have a great industry, a trained air-army.

If that is "waste of $640,000,000" then let us "waste" some more.

And if it is not a real waste, but if it has been done in spite of mistakes, errors, wrong leads and false starts, is it not rather a matter for praise than blame that there were enough men of enough vision and enough courage to go ahead and *do*, to make some sort of move and some sort of progress, to have the courage to learn the right even if they did so by doing the wrong and so in the end gave to America what no strictures and no official censure can take away, a going, producing, ably organized and efficient aircraft industry?

Making Soaps and Munitions from the Garbage Pail

A CAMPAIGN for the utilization of garbage has been inagurated by the United States Food Administration, which is advising all State administrators to spread garbage utilization propaganda through their territory and urge upon housekeepers the necessity for keeping garbage (kitchen and table refuse) in a separate container from other house refuse.

Figures and statistics issued by the Food Administration show that in one ton of garbage there is sufficient glycerine to make the explosive charge for fourteen 75-millimeter shells, enough "fatty acid" to manufacture 75 pounds of soap, fertilizer elements to grow 8 bushels of wheat, and a score of other valuable materials essential in the manufacture of munitions.

It is also pointed out that 24 cities of over 100,000 are not utilizing garbage and that the combined population, which is estimated to be over 5,000,000, is wasting 4,400,000 pounds of nitroglycerine and 40,000,000 twelve-ounce cakes of soap, besides 60,000 tons of tankage which contains fertilizer elements sufficient to produce a 3,000,000-bushel wheat crop. The value of this loss of materials is estimated at $5,000,000.

In 29 cities where there are garbage utilization plants the figures show that a combined population of 18,000,000 people are utilizing these products, to the value of $11,000,000 annually, and that a large percentage of this saving is being directly used by the Government in munition making. Plans are under way in several cities for the manufacture of alcohol on a large scale from garbage, and from experiments it has been shown that the grade of alcohol produced equals a high-grade grain product.

But in these 29 cities, or most of them, large amounts of garbage are destroyed by burning or made useless by being mixed with other wastes. This means that around 9,000,000 pounds of grease is lost, or sufficient to produce 1,300,000 pounds of nitroglycerine, which would furnish the powder charge of about 2,000,000 shells of the famous French "seventy-fives." In addition there is a loss of fatty acids sufficient to manufacture 25,000,000 twelve-ounce cakes of soap.

The fertilizer waste amounts to 1,250,000 pounds of nitrogen, 3,500,000 pounds of phosphate of lime, and 350,000 pounds of potash, or enough for the replacement of the elements removed from the soil by 1,000,000 bushels of wheat—in other words, a waste of 22,500 tons of fertilizer.

If in these 29 cities the garbage was "kept clean," or free from bottles, tin cans, crockery, and other foreign matter, the saving to the Government would be many millions more. The responsibility devolves upon the shoulders of the housewife who is urged to see that nothing but garbage goes into the garbage pail. Other house refuse has a value, but its value is lost and the value of the garbage is lost if refuse and garbage are mixed.

The Liberty Aero Oil Which Meets the Requirements of Aviation

THE Department of Military Aeronautics has announced the specifications for a new aircraft engine oil, known as the Liberty aero oil, developed while the lubrication branch was a part of the Equipment Division of the Signal Corps. The new oil is a mineral oil, and will be used in the Libery engine, as well as all stationary aircraft engines both here and abroad by the Army and Navy. Its development is due to the energy and skill of a staff of men who have worked exclusively on the problem for upward of twelve months. One officer so exhausted himself by his devotion to the subject that he became ill and died. The name of this officer was Capt. O. J. May.

When the aircraft program was announced in 1917, no one in authority had a definite idea as to the proper kind of lubrication required. Both at home and abroad the practice has been far from unifrom. For nearly every engine there was a specific oil.

An airplane is useless without an engine, and in turn the engine powerless without oil. Some engineers insisted on castor oil mixed with mineral oil; still others wanted mineral oil alone. At that time it was estimated that 5,000,000 gallons of castor oil alone, at about $3.00 per gallon, would be required. Neither that amount nor any amount of any other oil was available.

A new American engine was being designed and new lubrication problems were continually arising. Those in authority set out to develop a suitable lubricant at an average cost of about 75 cents per gallon and also a system for reclaiming oil already used. The result was the beginning of an oil survey.

Among the first lubrication experts attached to the new department was Capt. May, of Chicago. In 25 days he supervised personally the running of 37 engine tests in a laboratory where five engine tests a week would be a complete program. These engines were run with different kinds of oil, and each oil was analyzed and measured before and after tests. This work consumed a great amount of vitality and required such ceaseless vigil that the endurance of the investigator was exhausted when the work was completed. To determine how lubrication and fuel would serve at high levels, Capt. May then went to the altitude testing laboratory, an air-tight building

Is It Not Sound Policy

for you to do your banking business with a Trust Company?

Such a company not only can look after your money while you are alive but, if you wish, can act as Executor, Administrator, Guardian, Receiver or Trustee. It is a Legal Depository for funds of every description.

This Company especially attends to the management of Personal Property and Real Estate and to the collection and remittance of rents, interests and dividends.

Our officers will be glad to confer or send you information concerning any of our banking or trust services.

Write for our booklet "Management of Your Estate"

Central Union Trust Company
OF NEW YORK
80 Broadway—54 Wall Street
BRANCHES
Fifth Ave. at 60th St. Madison Ave. at 42d St.
Fifth Ave. at 38th St.

Capital, Surplus and Undivided Profits $29,000,000

Keep the Men Folks Working

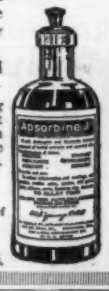
Keep on hand and have ready for emergency the always-safe antiseptic liniment and germ-destroyer Absorbine, Jr. It is healing, cooling, soothing. It gives prompt relief from aches and pains. It keeps little cuts and bruises from being infected.

Absorbine Jr.
THE ANTISEPTIC LINIMENT

With everybody working so hard and so fast nowadays more accidents seem to happen, more folks get hurt—even the youngsters get more cuts and bruises. Be on the safe side—be prepared—have Absorbine, Jr. in the medicine closet and be ready for emergencies.

It is harmless—safe and pleasant to use.

Stiffened muscles and aching joints from housework yield at once to Absorbine, Jr. Swollen feet, after a hard day's work, are rested by it. Get a bottle today.



$1.25 A BOTTLE
At druggists or postpaid
A Liberal TRIAL Bottle
Will be sent postpaid upon receipt of 10c in stamps.

W. F. YOUNG, P. D. F.
361 Temple St. Springfield, Mass.

Bessemer Oil Engines Reduce Overhead

IT entirely is possible for us to show you beforehand the saving that will accrue to you by installing a Bessemer Oil Engine. The saving in space required is one item, the lower cost of crude oil is another, and so on. This makes it possible to guarantee results, and to do all this before you obligate yourself to spend a cent. 15 to 180 H. P. Write us about your requirements.

The Bessemer Gas Engine Co.
14 York Street Grove City, Pa.

BESSEMER
OIL ENGINES

DO YOU *develop and print your own* **PICTURES**

Then use a new commercial American developer (De Nova) not approached in chemical quality by any similar American product. *Better than Metol.*

No matter how many developers you have experimented with—try **DE NOVA**

FREE SAMPLES sent on receipt of self-addressed stamped envelope.

Special Offer to Dealers

SPECIAL MATERIALS CO., *Mfg. Chemists*
1401 Livingston Street Brooklyn, N.Y.

capable of having the air within it partly exhausted and kept in that state. In other words, the air pressure within this compartment could be reduced and kept constant by means of exhaust air pumps. In this manner the reduced air pressure could be made equivalent to the air pressure at any elevation. Here the engines were tested for altitude, instead of trying to fly them for any length of time at the corresponding heights, or taking them up to the top of some mountain.

In the first tests Capt. May ran a 65-hour test without a stop. He stood watch without leaving the work until it was finished and his data was recorded. This continued strain on his vitality proved too great and on an inspection trip shortly afterward he was caught in a severe storm, fell ill, and died at Takoma Park, D. C., on May 22nd last.

On Capt. May's reports were based the Liberty aero oil specifications which are in general use in the Army and Navy today. His experiments made possible the securing of a suitable airplane engine oil at about a fourth the price of castor oil, saving the Government perhaps $11,000,000. Reclamation of used oil is also practiced now and at least 50 per cent is used again, whereas previously it was thrown away. This probably also saves the Government several million dollars.

How the Swiss Grow Potatoes in a Limited Area

WITHIN the past two years there have been numerous descriptions in the American press of the multi-layer method of growing potatoes either where ground is at a premium such as in large centers of population, or where the soil is too shallow to sustain crops, such as in the mining regions.

The usual method is to choose a small area of ground, which may be 20 feet square, more or less. This is surrounded by a common rail fence, or other form of inclosure, such as a picket fence, having interstices of a few inches and built 8 or 10 feet high. A layer of earth and manure is laid, and in this potatoes are planted after the usual manner. Upon this first layer 50 successive layers of earth and manure are superimposed, and potatoes are planted in each of the layers.

The vines of the potatoes emerge not only from the top but also through the interstices of the inclosure until it has become a mass of surrounding vines. The yield is said to be phenomenal, considering the area covered and the labor and expense involved.

Now the potato holds a place among the people of Switzerland little below that of bread. The country is rather pastoral than agricultural, and potatoes as well as wheat are imported. The scarcity and high price of potatoes press heavily upon the populace. To remedy this the people are turning to what they call the American method of production. Back yards and small spaces are being utilized; and as there are no rail picket inclosures are erected, and the plan of construction and planting already referred to are frequently to be seen. It is reported that the crop outlook is most promising, and should the yield prove satisfactory, the question of domestic production will have been solved, as it would easily lie within the power of many Swiss families to raise their own potatoes upon areas of ground insufficient when cultivated by ordinary methods.

Cure of Tuberculosis

PROF. LO MONACO, who is director of the Institute of Biological Chemistry connected with the Academy of the Lincei, at Rome, lately announced in an official communication that he had been able to make a great advance in the cure of tuberculosis. This result is obtained by a new method which is much simpler than all the serum methods experimented with during recent years.

Instead of attacking the bacillus itself, whose conditions of life, reproduction and resistance to outside influences are even now only imperfectly understood, the author proposes to modify the surroundings in which the microbe lives and thus to make its existence impossible. His paper is entitled "Action of sugars on the bronchial secretion," and is the result of very careful researches made since 1907.

At the outset, the author observed the action of sugar on all the secretions of the human organism. At first he made detailed observations on secretion of milk, and proved that saccharose solution applied by hypodermic injection upon goats had the effect of materially increasing this secretion, even where the solution is used in a very small amount, but on the other hand, large amounts act to lessen the secretion. All these effects take place, however, without modifying the composition of the milk. These curious results were also confirmed upon women. In 1914, he was able to establish with certainty that the amounts of various secretions such as saliva, bile, gastric juice and pancreatic juice, were modified to a

RIKER
TRUCKS

BUILT BY
THE **LOCOMOBILE** CO.
OF AMERICA · *Bridgeport, Conn.*

LAPIDOLITH
TRADE MARK

The Liquid Chemical Hardener will dustproof and harden your Concrete Floors.

Ask your workmen about your concrete floors. Find out the damage done by concrete dust and how fast the floors are disintegrating.

Lapidolith seeps into old and new concrete floors and immediately unites with the Portland Cement, creating a new crystalline material which fills the pores and holds the sand firmly in its bed.

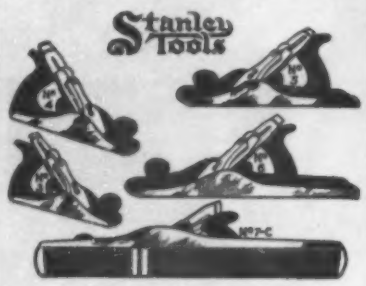
The microscope and the camera have shown the "reason why" Lapidolith hardens concrete.

These are some of the concerns which have used and recommended Lapidolith:

Ford Motor Co., Bethlehem Steel Co., Carnegie Steel Co., Armstrong Cork Co., Cluett Peabody Co., B. F. Goodrich Rubber Co., Anheuser-Busch Co., Continental Can Co., Washburn Crosby Co., Libby, McNeil & Libby, American Writing Paper Co., Fownes Glove Co.

If you have conerete floors then use Lapidolith. Prove its practical value. Send for free samples and testimonials.

L. Sonneborn Sons Inc.
Dept. 1
264 Pearl St. New York



Bailey Iron Planes

"Bailey" Iron Planes have been in use for nearly fifty years, and are the recognized standard for Planes of this type.

While retaining all the original features, many valuable improvements in construction have been added from time to time. Only the finest materials and the best workmanship are used in their manufacture.

Always insist that your order be filled with Planes made by THE STANLEY RULE & LEVEL CO., which carry with them a GUARANTEE backed by a Company that has been manufacturing Carpenters' and Mechanics' tools for over half a century.

For Sale by all Hardware Dealers.

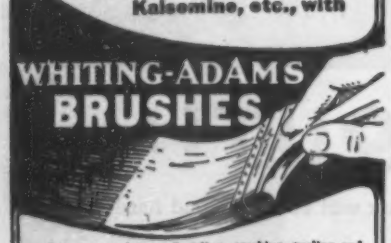
STANLEY RULE & LEVEL CO.
NEW BRITAIN, CONN. U.S.A.

PAINT, VARNISH, KALSOMINE, ETC.

will not adhere fixedly if applied in any way which does not rub them into the pores of the surface covered, so as to permanently bind them. Throwing paint, etc., at a surface is a cheap, make-shift method, gives only a skim coat, which too often brings trouble.

Rub in good Paint, Varnish, Kalsomine, etc., with

WHITING-ADAMS BRUSHES



and they never let go. Crawling, cracking, peeling and other defilities are sinful as well as expensive, and can be avoided. SEND FOR ILLUSTRATED LITERATURE. Dept. A

John L. Whiting-J. J. Adams Co., Boston, U.S.A.

Brush Manufacturers for Over 100 Years

Whiting-Adams Brushes Awarded Gold Medal and Official Blue Ribbon, Highest Award at Panama-Pacific Exp'n, 1915

Shoot Without Noise

IMPROVE your aim, raise your score of hits, do away with wincing, and get more sport out of shooting than you've had in many a day. Completely swallows the nerve-racking report. Allows women, children, the whole family, to shoot. It's simple; a

MAXIM SILENCER

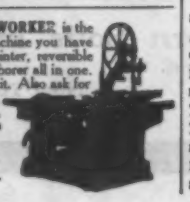
ON YOUR GUN DOES THE TRICK

Makes a fine gun for the shooter. At your dealer's. Book of queer Maxim Silencer experiences free.

THE MAXIM SILENCER CO.
94 Homestead Avenue,
Hartford, Conn.

BOOK FREE

THE No. 51 UNIVERSAL WOOD WORKER is the most wonderful wood working machine you have ever seen. 26" band saw, 6" jointer, reversible single spindle shaper, saw table and borer all in one. Ask for special catalog describing it. Also ask for catalog of band saws, saw tables, jointers, variety wood workers, planers, swing saws, disk grinders and borers.



THE CRESCENT MACHINE CO.
230 Main St., Leetonia, Ohio, U.S.A.

very great degree upon introducing sugar into the organism.

He then sought to explain the way in which this action takes place, and found that it consists in a marked expansion and contraction of the blood vessels of the organs in question, and this takes place according to the amount of sugar substance employed. This he confirmed by observing the method of action of the sugar solution in surface or deep hemorrhages, and found a marked action in stopping the flow of blood, as well as a considerable effect on the gland system. From these observations he was led to conclude that injections of sugar would have a marked action in modifying the bronchial secretions of tuberculosis patients.

With this end in view, he carried on a series of practical tests, and these far exceeded his expectations. His tests were made especially upon soldiers brought from the front and affected with tuberculosis, and here he found a rapid improvement. Then he succeeded in making cures which were recognized as final by skilled persons. Under this treatment it is found that the cough, night sweats and fever ceased entirely. As to the cause of this beneficial action, the author considers that it is very simple. Under the influence of saccharose injections, the bronchial secretion diminishes rapidly, and then ceases altogether. But this secretion constitutes the environment which is indispensable to the life of the bacillus, and when deproved of this, its vitality diminishes and it can no longer propagate. In this way the tissue ceases to degenerate, and the cavities become sealed over by scars, and in a short time the lungs resume their normal action.

It will be seen from the foregoing considerations that if the present discovery is all that is claimed for it (which of course remains to be confirmed), the problem of the cure of tuberculosis is practically solved, and this by the use of a very simple method. The above statements must be given due weight, from the reputation and position of the author, the scientific body to which he belongs and the length of time and great care used in the present researches. Another point to be considered is that repeated failures in the various serum cure methods lead to the idea that the action should be directed upon the lung environment and not upon the microbe itself. This is in accordance with the opinion of leading French scientists. Since the above account appeared, there has been some discussion on the subject in Paris medical circles, and opinions are divided. But whatever may be the final outcome of the present researches, they are at least of great interest.

Cottonseed Oil Cakes as Fuel in Egypt

THE high price of coal and the shortage of ocean freight space have produced a condition in Egypt under which cottonseed oil cake is being used as a substitute for coal as fuel. The crushing industry in Egypt produces a maximum of about 85,000 tons of cottonseed oil cake annually for which there is no local consumption. As the result of a lack of shipping facilities, large stocks of cake accumulated in Egypt. The high price of coal coupled with a desire for economy in its uses induced experiments with local products as a substitute. The relation of the calorific value of cake to coal was found to be 1¾ tons of cake to one ton of north country large coal.

The present price of coal in Egypt is about $80 per ton. The price of oil cake has been fixed by the government at various times during the past two years at a figure ranging between $32.50 per ton and the present price of $15. Cake is now being largely used in place of coal in boiler plants, in hotels, restaurants, and private houses. Boilers and stoves, it appears, are not detrimentally affected through the burning of the cake. One large concern saves two men per boiler in burning cake instead of coal. Cake ash has a value as fertilizer of about $25 per ton.

Finding the Right Job for the Right Man in the Army

LATEST figures show that nearly 240,000 transfers of men from one unit to another have taken place in Army camps in this country as a result of occupational qualifications ascertained through the committee on classification of personnel of the Adjutant General's office.

The speeding up of preparations for over-seas service during the past few weeks has meant a great increase in the work of the committee. About 40,000 transfers have taken place each week recently.

Through the medium of the committee, an organization has been built up in all Army camps by which enlisted men and commissioned officers are classified according to occupational qualifications. In some of the camps, where as many as 2,500 men are received daily, a force of 200 trained interviewers is employed to ascertain full information regarding the men's occupations, education, experience, and special qualifications.

The central personnel bureau at Washington receives reports soon after the arrival at camp of each draft increment, showing the number of skilled and semi-skilled men in different occupations. The Signal Corps, Ordnance, Quartermaster, and other corps are constantly making requests for skilled men needed by their special troops. By means of the occupational classification the transfers are promptly made.

A general order which has just been issued requires that every enlisted man leaving the country shall have made out an occupational card. This enables officers on the other side to place men where they can be most useful.

Among men now being transferred because of occupational qualifications are mechanics, chauffeurs, chemists for gas defense work, physicists and meteorologists for aviation purposes, surgical instrument repairers, bacteriologists, map draftsmen, refrigeration experts, crane operators, foresters, railroad builders, railway shop workmen, accountants, gunsmiths, and other ordnance specialists and workmen for engineer regiments.

New Way to Separate Materials Having Different Gravities

THE separation of materials of different specific gravities by means of a fluid having a specific gravity greater than the lighter particles and less than the heavier particles has not been applied commercially or on a large scale to the separation of ores or to the washing of coal, the method being limited to laboratory experimental work or to laboratory determinations for the purpose of checking up the work of jigs, classifiers, and other types of concentrating appliances. A solution of zinc chloride has thus come into general use in the laboratory to separate coal, bony coal and slate for test purposes. Difficulties that are practically insuperable, however, have prevented the commercial development of the use of such solutions for making separations on a large scale, these difficulties being both physical and financial. The cost of the chemical used to make high-gravity solutions is usually prohibitive, and the freeing of the coal from all traces of the chemical is found to be practically impossible.

It has been found that a mechanical mixture of water and fine sand created and maintained by agitation will have sustention and therefore selection qualities similar to those of a real solution in which bodies having greater specific gravity will sink and those of less specific gravity will float. A mixture of sand and water can be used to produce a fluid mass having a specific gravity suitable for the separation of coal from its impurities. Fluid masses, having specific gravity high enough to float quartz, feldspar, limestone and other rocks can be produced by using magnetic iron-ore sand and water instead of quartz sand and water. Other heavy materials can be used, such as ore concentrates of galena, metallic copper, etc., for producing fluid masses having very high specific gravities.

Glazing Without Metal

IN the already known art glazing processes the small individual panes of glass are bordered or "framed" with lead and then all of them are joined together to form the colored glass window or other decoration. Since the advent of the war, however, the use of metals of all kinds has been more and more restricted in Germany, so that it has been necessary to find some suitable substitute for this purpose.

According to a new process the single pieces of glass are arranged in the manner desired upon a fireproof backing and are then joined all together by heating in the kiln with the aid of a good glass flux. As soon as this first fusion has been effected the entire piece of work, together with the backing, is withdrawn from the kiln, finely powdered glass flux is filled into all crevices and joints and it is then melted by the assistance of a blowpipe. The piece of work is now ready for mounting in position, and absolutely no leading or metal bordering of any kind is required. The artistic effect is also enhanced.

A Respectable Use for Garlic

A PERFECTLY new raw material for the manufacture of a strong adhesive has now been found, in Germany, in the shape of garlic. According to a patent recently granted, garlic yields a glutinous substance of high adhesive power. The bulbs are crushed and pressed, and the juice thus obtained is boiled down at a temperature of 60 degrees C. The residue from the pressing process is then boiled in water for an hour, and again subjected to pressure; and the juice obtained is in its turn boiled down and added to the extract first obtained. The final product yields an excellent adhesive and binding medium. Not only cultivated, but also wild, types of garlic can be treated in this way with the same result. The yield of adhesive amounts to from 70 to 80 per cent of the raw material.

ADVERTISING CLASSIFIED

LATHES AND SMALL TOOLS

Friction Disk Drill

FOR LIGHT WORK

Has These Great Advantages.

The speed can be instantly changed from 0 to 1600 without stopping or shifting belts. Power applied can be graduated to drive, with equal safety, the smallest or largest drills within its range—a wonderful economy in time and great saving in drill breakage.

Send for Drill Catalogue

W. F. & Jno. Barnes Company
Established 1872
1999 Ruby Street Rockford, Illinois

SOUTH BEND LATHES

Established in 1906 Making Lathes over 10 years

For the Machine and Repair Shop
LOW IN PRICE
12 in. to 24 in. swing
Straight or Gap Beds
Send for free catalog giving prices on entire line
South Bend Lathe Works
421 Madison St.,
South Bend, Ind.

Cleveland Grindstones
It's in the Grit

The only *genuine* Berea Stone. Possesses just the right degree of hardness to put a keen edge on all cutting tools without destroying the temper of the tools. Used by majority of mechanics and Industrial Schools.

Write for folder "Selection and Care of a Grindstone"

The Cleveland Stone Co.
1129 Leader-News Bldg.
Cleveland, O.

THE MIDGET SLIDE RULE

will add, subtract, multiply, divide; solve problems involving even and uneven roots and powers. Also gives the Logarithms of Numbers and the Sines, Cosines, Tangents and Cotangents of all angles. Its operation is very simple; quickly solves any mathematical problem. Durably made of metal. Adapted for shop and office use. Fits the pocket. 3¼" in diameter. Price with instructions **$1.00**

Send for free descriptive circulars.

Your money back if you are not satisfied.

GILSON SLIDE RULE CO., Niles, Mich.

RED DEVIL Side Cutting Plier

GOOD TOOLS SPEED UP WORK

Tools drop-forged of tool steel with improved features and carefully tested, eliminate guesswork and uncertainties in producing quick results.

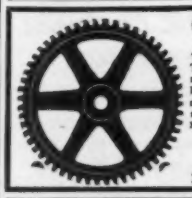
"Red Devil" Tools

remove the poor-tool handicap. Made of a known standard, for all mechanics.

Tool Booklet Free

Smith & Hemenway Co., Inc.
93 Colt Street Irvington, N. J.

GEARS
All Kinds—Small



The most accurate made and prices reasonable. We carry a complete line of gears in stock for immediate shipment. Can also quote on special gears of all kinds. Send us your inquiries.

Write for Catalogue

CHICAGO STOCK GEAR WORKS
20 South Wells Street Chicago

SETS OF CASTINGS OF MODEL ENGINES
GEAR WHEELS & PARTS OF MODELS

MECHANICAL SUPPLIES AND MATERIAL of all kinds
EXPERIMENTAL AND LIGHT MACHINE WORK to order
122 MILK STREET, BOSTON

TELESCOPES

W. & D. MOGEY
PLAINFIELD, N. J.

THE BRIDGEPORT CHAIN CO.
Specialists in Small Wire Shapes & Flat Stampings
Bridgeport, Conn.

MODELS CHICAGO MODELWORKS
ESTABLISHED 1867 166 W. MADISON ST. CHICAGO, ILL.
WRITE FOR CATALOGUE OF MODEL SUPPLIES

EXPERT ASSISTANCE In Model and Experimental Work
Automobiles, motors, engines and parts.
Inventions developed to completion
Light Mfg., Screw Machine Work, Special Machinery, Stamping
ELK MANUFACTURING CO., Inc., 1926 Broadway, N. Y. C.

HANDY MAN'S WORKSHOP AND LABORATORY

Compiled and edited by A. Russell Bond. 6x8¼ inches. Cloth. 467 pages. 370 illustrations. $2.00.

A compilation of hundreds of valuable suggestions and ingenious ideas for the mechanic and those mechanically inclined. The suggestions are practical and the solutions to which they refer are of frequent occurrence. It may be regarded as the best collection of ideas of resourceful men published.

Munn & Co., *Inc.* Woolworth Bldg., New York

NEW BOOKS, ETC.

FIFTEEN THOUSAND USEFUL PHRASES. By Grenville Kleiser. New York and London: Funk and Wagnalls Company, 1918. 8vo.; 453 pp. Price, $1.60 net.

Properly used, a good phrase book may enlarge the vocabulary and enrich the expression; improperly used, it has been known to ruin a racy simplicity of speech and turn pungency into platitude. The compiler has minimized this danger by classifying the terms as "literary," "commercial," and "conversational," so that a man of the poorest judgment need not confess, on the receipt of an order for merchandise, that he is "beside himself in an ecstasy of pleasure," nor is the lover likely to send his lady, instead of flowers, a note to the effect that "our stock has been temporarily exhausted." Speakers and writers of judgment will use the work as a mine of suggestion, not as a treasure chest from which to lift phrases bodily; used thus, its helpfulness is apparent. It will lead to the development of good taste and a mastery of language, and is a welcome supplement to the dictionary and the thesaurus.

THE ADVENTURES OF ARNOLD ADAIR, AMERICAN ACE. By Laurence La-Tourette Driggs. Boston: Little, Brown and Company, 1918. 8vo.; 335 pp.; illustrated. Price, $1.35 net.

Adair, a young New Yorker educated in Switzerland, is motoring in Austria at the outbreak of the war. He enters the French Flying Corps, and the narrative of his exploits over the Western Front will be breathlessly followed by young readers. The tale is far above the average boy's book of adventure. It is better written and its details, many of them very informing, are skillfully introduced. National types are brought into contrast, the story goes with an electrical verve, and the pictures are such as a boy will gloat over.

SEVEN LEGS ACROSS THE SEAS. A Printer's Impressions of Many Lands. By Samuel Murray. New York: Moffat, Yard and Company, 1918. 8vo.; 408 pp.; illustrated. Price, $2.50 net.

The sea breeze itself permeates this narrative of a printer's trip around the world, "with little more than the clothes on his back and his union card." The various "legs" of the journey take him to England, South America, Africa, Australia, India and the Orient. His observations of scenery, peoples and things have a freshness and enthusiasm that are reflected in his account and make it different from the ordinary book of travel. There is a little history, and much comparison and criticism that is on the whole shrewd and fair; he has managed to find aspects that are infrequently touched upon by travelers, and several of the rather numerous illustrations accentuate the originality of his outlook.

REGULATION OF RAILWAYS. Including a Discussion of Government Ownership versus Government Control. By Samuel O. Dunn, Editor of *The Railway Age*. New York and London: D. Appleton and Company, 1918. 12mo.; 364 pp. Price, $1.75 net.

Before our entrance into the war the seriousness of the railway problem had been brought home to nearly all of us. The author, who has made a study of transportation and has written several thoughtful works on the subject, here reviews the situation, and shows that regulation, while abating or abolishing certain abuses, has retained some unsound principles and produced some harmful results; a "multiplicity of overlapping laws and agencies operating independently of one another" did not make for ideal conditions. The system did not keep pace with important changes since 1906, changes produced by economic forces that have been left out of account. These forces and tendencies are studied, and suggestions are made that clarify the situation and place further research upon an intelligent basis.

FACING THE HINDENBURG LINE. By Burris A. Jenkins. New York and London: Fleming H. Revell Company. 8vo.; 256 pp. Price, $1.25 net.

Mr. Jenkins was either very lucky or very shrewd; by combining the functions of war correspondent and Y. M. C. A. lecturer he doubled his opportunities for observation. In the one character he could often go where, in the other, his presence would not have been tolerated. He seizes unfailingly upon the human side of events, and his fund of humor is unforced and unexhaustible. The chapter entitled "Americans must learn the game" gives us all food for thought. From front to front went the author during the campaigns of 1917 and, no matter where he went, we get an intimate picture of life and conditions. The Tommy and the poilu stand forth vividly from the background of ruin, void of affectation, determined in battle, cheerful in adversity. The author is particularly enthusiastic about Italy, the administrative and inventive genius she is displaying, the smooth-running machinery of supply, the courtliness and efficiency of her officers. The work has a freshness and a point of view that is all its own.

OUTWITTING THE HUN. My Escape from a German Prison Camp. By Lieut. O'Brien, R. F. C. New York and London: Harper and Brothers, 1918. 8vo.; 284 pp.; illustrated. Price, $1.50 net.

Pat O'Brien, a "Chicago Irishman" of the Royal Flying Corps, himself calls the incidents of his escape a succession of miracles. After a short but exciting career at the front, he was brought down on hostile soil; recovering from his injuries in a German hospital, he next tasted the bitter bread of the Courtrai prison-camp. As he was being transferred to a reprisal camp he leapt from the window of the flying train; caked with blood and mud, and clad in an R. F. C. uniform that advertised his standing to any who might see him, he performed the incredible task of traversing Germany, Luxembourg and Belgium, trudging the woods and swimming the streams by night, and living for the most part on the raw vegetables of the fields. His final feat of tunneling under the live-wire fence dividing Belgium from Holland was a worthy culmination of his astounding adventures, which are throughout modestly told.

THE LIFE AND DEATH, VIRTUES AND EXPLOITS OF GENERAL GEORGE WASHINGTON. By Mason L. Weems. Philadelphia and London: J. B. Lippincott Company. 8vo.; 288 pp.; illustrated. Price, $1.50 net.

To Parson Weems we owe the Washington of our early school days—the cherry tree, the inability to fib, and the proclivity for striking an heroic attitude; today, we don't believe in the priggishness of our country's father as depicted by the pastoral pen, and we like to think of Washington as taking more pleasure in striking for freedom than in striking an attitude. Nevertheless, this old book was a power in its day, and for many a day after; it was pored over by the young Lincoln, who confessed his preference for its god-like conception of Washington over any chronicle that treated the hero as a man like unto other men. The author himself admitted that the book was written to entertain; with his kindling fancy and undeniable descriptive powers he might, had he been born a century later, have turned out best sellers and five-reel films. At any rate, the work is a classic in its way, and should not be allowed to rest in oblivion. It will be a sorry hour for the country when hero-worship goes out of fashion, and this new Mount Vernon edition has given the old story a most attractive dress.

A FRENCH-ENGLISH MILITARY DICTIONARY. By Cornelis De Witt Willcox, Colonel, United States Army, Professor of Modern Languages, United States Military Academy. New York and London: Harper and Brothers, 1917. 8vo.; 600 pp. Price, $4 net.

The author calls attention to the fact that, with a knowledge of French alone, an officer can keep abreast of his profession almost as well as though he had at his command all other foreign literatures of military importance. It should be understood that the body of this solid compilation is exactly as originally published by the War Department, but in addition to this the work includes a supplement of more than seventy pages giving the important military and technical terms of more recent origin. The compiler has accomplished a difficult task in a most thorough and satisfactory manner; in bringing it up to October, 1917, he has given to officers and civilians a work that out-distances all existing dictionaries of this kind. In it may be found terms relating to aviation, trench warfare, artillery and camouflage, not omitting the racy and often very apt slang expressions that the soldier has invented. Full advantage has been taken of official military publications of the French government; officers of the visiting French commissions have lent their enthusiastic aid, and our own authorities have given their hearty coöperation toward making the dictionary accurate and complete.

THE TREASURES OF COAL TAR. By Alexander Findlay, M.A., D.Sc., F.I.C. New York: D. Van Nostrand Company, 1917. 12mo.; 150 pp.; illustrated. Price, $2 net.

Recent developments have forced the attention of the public to the important relationship of this by-product of the manufacture of coke and of illuminating gas to dyeing and textiles. The German monopoly in "intermediates" placed us, at the outbreak of the war, in a serious position. The author wishes to make sure that the lesson thus taught has been thoroughly learned, so that the future may not again hold such a threat against our textile industry. He speaks, indeed, from the British standpoint, but most of his statements are applicable to this country also. The book, then, is an effort to interest everybody in the subject, from the production and distillation of coal tar to its utilization in dyes and explosives. It places before the reader great chemical achievements, and shows their relation to health, comfort and national defense.

THE POLISH PEASANT IN EUROPE AND AMERICA. Monograph of An Immigrant Group. By William I. Thomas and Florian Znaniecki. Chicago: The University of Chicago Press, 1918. 8vo.; 1134 pp. Price, $5.50 net.

These are the first two volumes of what is evidently to be a monumental work of the greatest sociological significance, that will make its appeal and offer its aid to all students of history, psychology, education and economics. That it deals with the Polish peasant is incidental. Believing in the possibility of a control over social conditions as satisfactory as is our control over materialistic conditions, the authors believe also that it is first necessary to determine "the most general and particular laws of social reality"; that is, to gain a better understanding of questions such as are raised by immigration, racial prejudice, cultural assimilation, and the comparative mental and moral worth of nationalities; to distinguish between "unreflective social cohesion brought about by tradition, and the reflective social cooperation brought about by rational selection of common ends and means"; and to introduce new attitudes and values without recourse to the way of revolution. These considerations are as germane to American welfare as to that of any other country; and it is by the isolation and study of particular societies and individuals that the authors seek to grasp first principles and

1852
AUGUST
W.L.DOUGLAS WAS PUT TO WORK PEGGING SHOES AT SEVEN YEARS OF AGE
FISHING FOR AN HOUR OR TWO IN A NEARBY MILL POND ON RARE OCCASIONS WHEN THERE WERE NO SHOES TO PEG WAS PRACTICALLY THE ONLY PLAYING W. L. DOUGLAS EVER DID.
STAMPING THE RETAIL PRICE ON THE BOTTOM AT THE FACTORY PROTECTS THE WEARER AGAINST UNREASONABLE PROFITS.
W.L.DOUGLAS $5.00 SHOE
BEGAN MANUFACTURING
JULY 6 1876

FOR MEN AND WOMEN

W. L. DOUGLAS

"THE SHOE THAT HOLDS ITS SHAPE"

$3.50 $4.00 $4.50 $5.00 $6.00 $7.00 & $8.00

BOYS' SHOES Best in the World $3.00 $3.50

You'll never need to ask "What is the price?" when the shoe salesman is showing you W. L. Douglas shoes because the actual value is determined and the retail price fixed at the factory before W.L.Douglas name and the retail price is stamped on the bottom. The stamped price is W. L. Douglas personal guarantee that the shoes are always worth the price paid for them.

Stamping the price on every pair of shoes as a protection against high prices and unreasonable profits is only one example of the constant endeavor of W. L. Douglas to protect his customers. W. L. Douglas name on shoes is his pledge that they are the best in materials, workmanship and style possible to produce at the price. Into every pair go the results of sixty-six years experience in making shoes, dating back to the time when W. L. Douglas was a lad of seven, pegging shoes.

The quality of W. L. Douglas product is guaranteed by more than 40 years experience in making fine shoes. The smart styles are the leaders in the fashion centres of America. They are made in a well-equipped factory at Brockton, Mass., by the highest paid, skilled shoemakers, under the direction and supervision of experienced men, all working with an honest determination to make the best shoes for the price that money can buy. The retail prices are the same everywhere. They cost no more in San Francisco than they do in New York.

CAUTION—Before you buy be sure W. L. Douglas name and the retail price is stamped on the bottom and the inside top facing. If the stamped price has been mutilated, BEWARE OF FRAUD.

For sale by 106 W. L. Douglas stores and over 9000 W. L. Douglas dealers, or can be ordered direct from W. L. Douglas by mail. Send for booklet telling how to order shoes through the mail, postage free.

W L Douglas

President W. L. DOUGLAS SHOE COMPANY 163 SPARK STREET, BROCKTON - - MASS.

Starrett Tapes

For Quick, Accurate Reading

Accuracy and speed are assured because Starrett tapes are precise in graduations, plainly marked with bright figures on black background—so they are quickly and conveniently read.

Catalog No. 21 B describes other Starrett quality tools —2100 of them.

THE L. S. STARRETT COMPANY

The World's Greatest Tool Makers

Athol, Mass.

Insure Against Car Theft

The car thief is always on the job. He takes a good look before he grabs the wheel. If he spots a POWERSTEEL AUTOWLOCK, he shies. That Yellow Strand Wire Rope and unpickable spring lock beat him. That's why you save 10% on theft insurance in some companies. At dealers, $2.25 east of the Rockies.

BASLINE AUTOWLINE saves in another way—in time, when you need a tow. It's also Yellow Strand Wire Rope, fitted with patented snaffle hooks. At dealers, $4.95 east of the Rockies.

Truck owners value the POWERSTEEL TRUCKLINE for its superstrength and unfailing service. Write for literature.

BRODERICK & BASCOM ROPE CO., ST. LOUIS NEW YORK

Manufacturers of celebrated Yellow Strand Wire Rope

POWERSTEEL AUTOWLOCK

VENUS PENCILS

THE very best pencil in all the world is the VENUS. It meets *perfectly* the severest requirements.

17 black degrees 6B softest to 9H hardest with or without eraser tips and hard and medium copying—all perfect

FREE!

(except packing and postage)

Send 6c in stamps to cover actual cost of packing and postage and we'll send FIVE trial length VENUS Pencils and VENUS ERASER for test!

VENUS Erasers are made in 12 convenient sizes. They rub out cleanly and easily. Specify them.

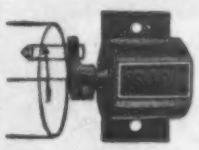
American Lead Pencil Co.

217 Fifth Ave., New York
and Clapton, London, Eng.

Hold Production to a Standard

Will you take what your machine gives you, or will you make it produce to the standard you set for it?—with a

Veeder COUNTER



The Revolution Counter at left registers one for a revolution of a shaft, recording an operation. A favorite for small machinery and experimental mechanics. Price, $1.75.

Suitable counters for the different types of machines will be found in the Veeder booklet—copy on request.

THE VEEDER MFG. CO.

18 Sargeant St., Hartford, Conn.

1000 Copies FOR 20¢

Form Letters
Ruled Forms
Bulletins
Price Lists
Illustrated Notices

Manufacturers, merchants, professional men, you can print from 20 to 1000 copies of any hand-written, typewritten or ruled form, quickly and perfectly with a

ROTOSPEED STENCIL DUPLICATOR

Prints on any size, weight or kind of paper from a 3 x 5 inch ruled index card to a 8½ x 16 inch sheet.

Sent on free trial with complete equipment for hand-written, typewritten and ruled work.

Write for factory price and free trial offer.

One Model Low Factory Price

The Rotospeed Co.
808 W. 6th St.
Dayton, Ohio

600 Shaves From One Blade

Yes, and more. That's the record of many men who shave themselves. Old blades made sharper than new—in 10 seconds. For all Safety Razors. Quick, upward stroke for life with wonderful, new

Rotastrop

Just drop blade in, turn handle. Nothing to get out of order. Machine gives "heel and toe action", just like a barber strops a razor.

10 Days Free Trial—write for booklet, state make of razor.

BURKE MFG. CO.
Dept. 986 Dayton, O.

to evolve working theories. In its narrower aspect, the work gives a remarkable insight into Polish ideals and interests at home and in this country; in its larger applications, it provides a basis of understanding that may be beneficially utilized by any to whom our social conditions and our national unity is a matter of paramount concern. These two volumes deal with family and commune groups; Vol. III will be the autobiography of an immigrant illustrative of the tendency to disorganization upon transplantation to a new environment; Vol. IV will consider the dissolution of the primary group and the reorganization upon a coöperative plan of peasant communities in Poland; and Vol. V will study the Polish immigrant in America and sketch the beginnings of reorganization.

THE CAUSES AND COURSE OF ORGANIC EVOLUTION. A Study in Bionergics. By John Muirhead Macfarlane, D.Sc. New York: The Macmillan Company, 1918. 8vo.; 875 pp.; illustrated. Price, $4.

In this profound study, the fruit of 40 years of labor, Dr. Macfarlane has given us a work that must be approached with respect. The evolutionary science of the day is an outgrowth of many sciences, a body of deductions from physics, botany and zoology, with sidelights from other branches of knowledge utilized to the full. As an instance of the difficulties involved in such a study as this, of the anomalies that urgently call for explanation and reconciliation, we may cite the widely accepted botanical theory that plant life, originating over fresh water areas, spread thence to the sea; against this is the zoological view that animal life originated in the sea and only afterward spread to the land. In this problem the author's conclusions are at variance with past theories, while his collations are worthy of the closest scrutiny. His work as a whole recognizes the principle of continuity as of "first and extreme importance," and carries this principle even into the realm of moral and religious organization; the secondary emphasis is placed upon energy, which is constantly asserting its predominance over matter and challenging the investigation of the keenest minds. The folding diagrams in color provide a means of placing significant facts and phenomena before the reader in an easily assimilated form.

MANAGING A BUSINESS IN WAR TIME New York and London: A. W. Shaw Company, 1918. 8vo.; 402 pp.; illustrated. Price, $3.

The publishers have taken possession of a great mass of opportune material, have culled it over, made selections with acute judgment, and finally present the cream of the yield in two handy volumes. In article after article, English men of business tell of their war experience, of war-time management methods that have won success, of the way in which they have solved the labor problem, the credit problem, the difficulties of buying, and the question of squaring national obligations with personal interests. Other authorities freely donate pointers of the greatest value in munition work, scientific rationing, and the training of boys and women to take the places of the men. In the second volume, American writers are to the fore, anticipating the general effect of the war upon business and prices, telling how to get the most out of the farm, discussing the motor truck as a war-time ally, presenting short cuts in financing, demonstrating the possibility of more production with fewer men, and in innumerable ways serving the industries that serve the guns. The final section is devoted to after-war problems in foreign trade. Many of the papers are by such distinguished and far-seeing executives as Lord Leverhulme, Lord Airedale and Sir Charles Wakefield—all heads of Britain's most prosperous enterprises; the American writers are no less authoritative in their special lines. It is to be hoped that our business men will give this work the attention it deserves, thereby avoiding costly mistakes and taking the most direct line to increased and improved output under changing conditions that at first glance seem almost hopelessly adverse.

TWO THOUSAND QUESTIONS AND ANSWERS ABOUT THE WAR. New York: The Review of Reviews Co., 1918. 8vo.; 352 pp.; with maps and illustrations.

From an attitude of aloofness, the United States has suddenly been called upon to inform itself upon other peoples, states and problems with which, to its amazement, it finds its own future inseparably involved. It is necessary that this war become "part and parcel of every individual life," and a knowledge of facts must become part of the individual equipment before this consummation may be reached. The maps, statistics and catechisms of this volume form an excellent popular textbook of causes, effects, events, and progress; of military methods in fighting, traveling, and living; of the land and sea forces and the air fleets; and of the geography and politics of the wide-flung territories affected, with the outstanding personalities of the men who are in direction. A separate section is devoted to our own conduct of the war, and the pronouncing dictionary will settle many arguments. There are 32 pages of new maps in color, and it would be hard to formulate a question in any way connected with the world conflict that is not asked and answered by this splendid and authoritative work.

JOSEPH PENNELL'S PICTURES OF WAR WORK IN AMERICA. Philadelphia and London: J. B. Lippincott Company, 1918. 4vo.; 36 drawings. Price, $2.

For some time this American artist has industriously applied himself to the grimly artistic phases of war work abroad. Here, back in his own land, he shows us giant locomotives swinging in mid-air; the "perpendicular cathedral" of the riveting shop; the gun pit, where "everything is done deep down under ground"; the balloon shed, with its tenant returning after an airing; great ships, great guns, monstrous engines, most of them in an atmosphere of murk and glow. These noteworthy pictorial records were authorized by our Government, which has placed them on exhibition throughout America. They are a fixation of history in the making; they show in the most vivid manner what we ourselves are doing to get ready. Moreover, these "fascinating but intolerable" aspects of the shops and material of war can be brought home to the individual only by pictures, and there is no artist better qualified to seize upon both the fascinating and intolerable and to express them in a new art that appeals intensely to the modern spirit.

MACHINE GUNS. Part I, Materiel, by Major Julian S. Hatcher, Ord. Dept., N. A., U. S. A. Part II, The Practical Handling of Machine Gun Fire, by Major Glenn P. Wilhelm, Ord. Dept., N. A. U. S. A. Part III, Machine Gun Tactics, by Major Harry J. Malony, Ord. Dept., N. A., U. S. A. Menasha, Wisconsin: George Banta Publishing Company. Price, $2.50.

The authors are thoroughly qualified to compile such a work as this, not only because of their knowledge of machine guns, but also because their experience in the Schools of Instruction has so well acquainted them with the needs of the student and the best means of imparting information. This second edition contains much new material while retaining the logical arrangement and admirable features of the first. Part I deals with history, development, types and classes; the characteristics of the principal guns are tabulated, and the student is made familiar with the various designs and parts and the methods of testing and handling. Part II takes up such subjects as marksmanship, fire training and ballistic problems; and Part III, the capacities of various guns and the manner of using them according to the character of the terrain and the nature of the opposing forces. The large folding sectional views of types include the Lewis gun, and numerous smaller illustrations and diagrams aid not a little in conveying accurate ideas of the guns themselves and of the principles involved in handling them.

FINDING AND STOPPING WASTE IN MODERN BOILER ROOMS. Vol. II. Philadelphia: Harrison Safety Boiler Works, 1918. 12mo.; 274 pp.; illustrated. Price, $1.

In the face of the urgent necessity for coal conservation, every plant designer, owner, manager and operator should awaken to the importance of economy in the boiler room. Papers, articles and extracts from various reliable sources are here brought together in logical sequence to form a body of concise information relating to fuels, combustion, heat absorption, boiler efficiency and testing, and boiler plant proportioning and management. The publications of the Bureau of Mines have been freely drawn upon; a notable result of the good judgment employed in the compilation is that it contains so much that cannot be found in works of a similar nature, yet all the practice is authoritative and practical.

BUGLE RHYMES FROM FRANCE. By Paul Myron. Chicago: Mid-Nation Publishers, 1918. 8vo.; 138 pp.; illustrated. Price, $1.

Paul Myron, although of Prussian extraction, is heart and soul for the Allied cause; echoes of the great fight for freedom come rippling to us on his rhymes, stirring our enthusiasm for our own boys in France, and calling up sharp pictures of their combats with the enemy, of their humorous and sentimental adventures on leave in Paris, and of the home scenes that flit before them as they fight or play. The flaming protest of the American mind against the methods of Kaiserism fires the whole body of verse; the author's experience as a cavalry officer enables him to sketch his characters with a sure hand. The volume includes "This Side of France," a comedy in prose, and the illustrations of François Olivier add to the attractiveness of the collection.

THE BIRTH OF THE RUSSIAN DEMOCRACY. By A. J. Sack, Director of the Russian Information Bureau in the United States. New York: Russian Information Bureau. 8vo.; 536 pp.; 42 full page, 154 text illustrations. Price, $2.65 net, $2.90 postpaid.

Of the flood of books on Russia now flowing from the presses, many are mere impressionistic sketches, interesting enough, but concerning themselves little or not at all with underlying historical facts. This substantial volume, penned by one who has the whole history of the revolutionary movement in his mind and the best interests of his country at heart, goes back to the Decembrist uprising of 1825, and traces the connection of this early reaction with the present revolution. The second portion of the work deals with the spiritual leaders of the later movement, and their lives and activities constitute a very complete and illuminating key to recent events, while the third part of the volume is a detailed recital of those events. This part abounds in citations from the documents and speeches of the Provisional Government, the Council of Workmen's and Soldiers' Delegates, the Congress of Peasants' Delegates, and the Labor and Socialist leaders; the stand of the middle class toward the war is made plain, the great crisis of July, 1917, is dealt with at length, and finally we see Russia under the rule of the Bolsheviki. While venturing but cautiously into prophecy, the author believes that the success of the Allied arms will mean that the new Russian democracy "will rise to the manhood which will make her, in President Wilson's words, 'a fit partner for a League of Honor.'"

LEGAL NOTICES

PATENTS

IF YOU HAVE AN INVENTION which you wish to patent you can write fully and freely to Munn & Co. for advice in regard to the best way of obtaining protection. Please send sketches or a model of your invention and a description of the device, explaining its operation.

All communications are strictly confidential. Our vast practice, extending over a period of seventy years, enables us in many cases to advise in regard to patentability without any expense to the client. Our Hand-Book on Patents is sent free on request. This explains our methods, terms, etc., in regard to *Patents, Trade Marks, Foreign Patents,* etc.

All patents secured through us are described without cost to the patentee in the SCIENTIFIC AMERICAN.

MUNN & CO.
SOLICITORS OF PATENTS
233 Broadway, Woolworth Building, New York
And 625 F Street, Washington, D. C.

Annual Subscription Rates for the Scientific American Publications

Subscription one year..... $4.00
Postage prepaid in United States and possessions, Mexico, Cuba and Panama.
Subscriptions for Foreign Countries, one year, postage prepaid..... $5.50
Subscriptions for Canada, postage prepaid.... 4.75

The Scientific American Publications

Scientific American (established 1845)..... $4.00
Scientific American Supplement (established 1876)..... 5.00
The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.
Remit by postal or express money order, bank draft or check.

Classified Advertisements

Advertising in this column is $1.00 a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

SCHOOLS

TECHNICAL TRAINING
FOR NATIONAL SERVICE
In the shortest time consistent with thorough preparation

Two-Year Courses in
MECHANICAL INDUSTRIES
APPLIED ELECTRICITY
APPLIED CHEMISTRY

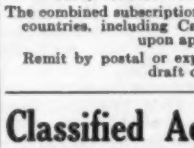
Technically trained men are urgently needed in the Army, the Navy and the War Industries

STUDENT ARMY TRAINING CORPS now being organized at Pratt Institute under U. S. War Department prepares for military service in either Army or Navy and allows students of draft age to complete above courses. All able-bodied men students over 18 eligible. Particulars on application.

Low tuition. Write for illustrated Catalog
Fall admission interviews, September 20

School of Science and Technology
PRATT INSTITUTE, Brooklyn, N. Y.

LEARN TO BE A WATCHMAKER
Bradley Polytechnic Institute—Horological Department



Formerly Parsons Horological Institute

Peoria, Illinois
Largest and Best Watch School in America
(This entire building used exclusively for this work)

We teach Watch Work, Jewelry, Engraving, Clock Work, Optics. Tuition reasonable. Board and rooms near school at moderate rates. Send for Catalog of information.

Indiana, Terre Haute,
ROSE POLYTECHNIC INSTITUTE
A College of Engineering. Courses in Mechanical, Electrical, Civil, Chemical and Architectural Engineering. Extensive shops, well-equipped laboratories in all departments, expenses low. 38th year. For catalog containing full information and professional register of alumni, address F. L. Mees, President

MANUFACTURING OPPORTUNITIES

BIG MONEY IN MATCHES. I will furnish you with machinery for making. W. E. Williams; 28 E. Jackson Blvd., Chicago, Ill.

CASH for OLD FALSE TEETH Don't matter if broken. We pay up to $25.00 per set, also actual value for diamonds, old gold, silver and platinum. Send by parcel post, and receive cash by return mail. Will return goods if price is unsatisfactory. Mauer's Tooth Specialty, Dept. 29. 2007 S. 5th St., Philadelphia, Pa.

RUBBER Expert Manufacturers Fine Jobbing Work
PARKER, STEARNS & CO.,
286-300 Sheffield Ave., Brooklyn, N. Y.

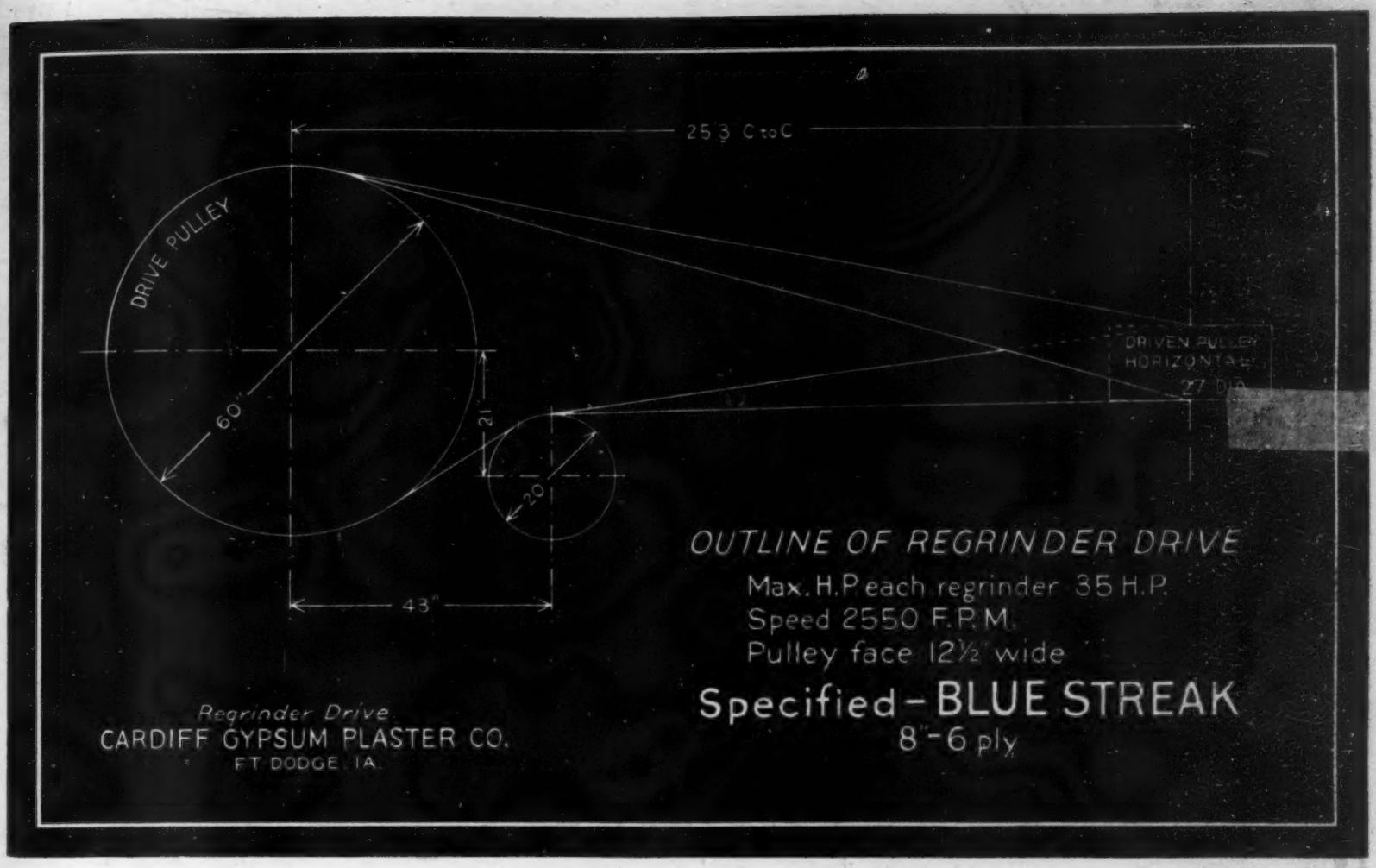
ICE MACHINES Corliss Engines, Brewers and Bottlers' Machinery.
The VILTER MFG. CO.
899 Clinton Street Milwaukee, Wis.

PICK, SHOVEL AND PLUCK

Further Experiences "With the Men Who Do Things." By A. Russell Bond. 5½x8½ inches. Cloth. 256 pages. 110 illustrations, including 58 page-plates and colored frontispiece, $1.50, postpaid $1.65.

A companion volume to "With the Men Who Do Things," taking the same two boys through a new series of engineering experiences. A fascinating and instructive book for boys, relating how many big things in engineering have been accomplished.

MUNN & CO., Inc. Publishers, Woolworth Building New York City



That Regrinder Drive—and the G.T.M.

The basic industries, those converting essential raw materials for commercial uses, find belts of all sorts a heavy item in costs. Whether they work with metal ores or wood, with wool or clay, with sugar-cane or stone, their transmission cost is high—and there is always some one drive that fairly devours belts. The crushed stone industries—cement, crushed rock, brick and gypsum—have the belt-eating regrinder drive. The conditions surrounding it vary with the plant, but they are always destructive enough to jump production costs.

Out in Iowa the Cardiff Gypsum Plaster Company tried on it every kind of belt they could buy. None lasted long; all stretched, slipped, and required repairs that wasted the time of men and machines. One day a G. T. M.—Goodyear Technical Man—called on them. They asked him the price per foot of a Goodyear Belt for the regrinder. The G.T. M.—our Mr. Russel—told them that no G.T. M. sold belts that way—that if Goodyear Technical Men were only talking price lists, it would be better to send out monthly phonograph records to reel off quotations. Then he told them about the Goodyear plan of Plant Analysis, of analyzing the conditions surrounding each drive and prescribing the proper Goodyear Belt to fit. They were interested—and took him to the regrinder drive.

The G. T. M. noted that a 60-inch vertical pulley drove a horizontal one of 27 inches—that the pulley faces were 12½ inches wide—that the distance between centers was 25 feet 3 inches—that there was a 20-inch idler—that the maximum horsepower was 35—the belt speed 2550 feet per minute—and the load extremely variable. He prescribed the Goodyear Belt made for just such service—an 8-inch 6-ply Blue Streak.

The belt arrived soon and was put to work. It was amazingly successful. After two and a half years of service it was still running, and had never stretched, slipped or required attention of any sort. Other belts had given out in a few months. As soon as it had run longer than any other belt, the G. T. M. was asked to analyze every drive in the plant and to prescribe the proper belt.

He did it and his prescriptions are being followed. All of them show a real saving over former installations. The experience of the Cardiff Gypsum Plaster Company with Goodyear Belts and the G.T. M. is similar to that of thousands of others in every national industry. If you have a troublesome belt devourer in your mill, factory or mine, send for a G.T. M. His service is free—for our reward comes in the increasing orders for the belts he prescribes.

THE GOODYEAR TIRE & RUBBER COMPANY
AKRON, OHIO

BELTING · PACKING · HOSE · VALVES

GOODYEAR

AKRON

WARTIME SERVICE

MACK Trucks are going over the top in wartime service—standing up under gruelling 24-hour-a-day work—at home and over there.

They hurry machinery, and urgently needed equipment to factories, docks and shipyards with unexampled speed and certainty.

MACK Trucks not only equal railroad performance, but far surpass it. Between New York and Akron, MACK Trucks chop 48 hours from the running time of the fastest railroad freight. They average the 533 mile trip in 60 hours. MACK fast express vans equal this record on many other long routes.

Wherever used, MACK Trucks add efficiency to transportation by day-after-day operation—by complete fitness for load and road—by ability to get through on schedule time.

Sizes range from 1 to 7½ tons Trailers to 15 tons. Bodies made for all purposes. Write to Department N for further information.

INTERNATIONAL MOTOR COMPANY
New York

"PERFORMANCE COUNTS"

Our subscribers are requested to note the expiration date that appears on the wrapper in which they receive their copies of SCIENTIFIC AMERICAN. If they will send in their renewal orders at least two weeks prior to the date of expiration, it will aid us greatly in rendering them efficient service.

GENERAL LIBRARY
SEP 16 1918
UNIV. OF MICH.

NOTICE TO READER
When you finish reading this magazine, place a one cent stamp on this notice, mail the magazine, and it will be placed in the hands of our soldiers or sailors destined to proceed overseas. NO WRAPPING, NO ADDRESS.
A. S. Burleson, Postmaster General.

SCIENTIFIC AMERICAN

A DUEL BETWEEN BRITISH AND GERMAN SUBMARINES [See page 215]

September 14, 1918

Munn & Co., Inc., Publishers
New York, N. Y.

Price 10 Cents

Everlastin' Team Work

THAT fine spirit which the American people are showing in their determination to win the war opens the way for this pronouncement of policy covering the needs of the government as against the needs of individuals.

As manufacturers of a product which alike meets the needs of a nation at war and the needs of individual Americans engaged in essential industry, the General Motors Truck Company owes this expression of appreciation to those whose orders have been delayed. And the spirit with which these prospective customers have bowed to the greater needs of the war is hereby gratefully acknowledged.

Either directly or through priority orders, those loyal Americans whose manufactured products may be utilized for war purposes are giving the government first call, and we, being in that class from the standpoint of production, are in turn, dependent on those who produce the raw materials that go into our own finished product.

So two conditions stand in the way of deliveries—factory production is curtailed by scarcity of material, and output for industrial needs is limited by government demand.

Could we run the factory at capacity both demands might be filled with reasonable promptness.

Until this situation improves, however, we ask the indulgence of all GMC customers—those who already own GMC Trucks and those who seek to buy.

"The everlastin' team work of every bloomin' soul," as Kipling puts it, will solve the problem—will bring about the day when war will be no more; when peaceful industry may resume the development which war has so ruthlessly interrupted.

GENERAL MOTORS TRUCK COMPANY

One of the units of the General Motors Corporation

Pontiac, Michigan

Branches and Distributors In Principal Cities

(415)

GMC TRUCKS